

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 06-089314

(43)Date of publication of application : 29.03.1994

(51)Int.Cl.

G06F 15/60

G06F 9/44

(21)Application number : 05-043527

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(22)Date of filing : 04.03.1993

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(30)Priority

Priority number : 04 96271
 04191880

Priority date : 16.04.1992
 20.07.1992

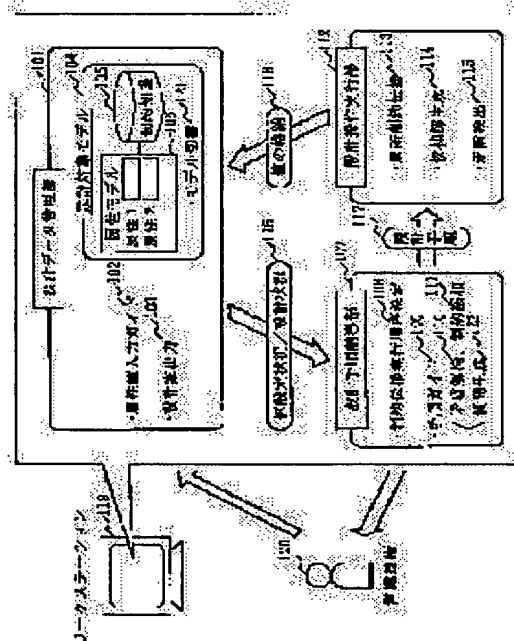
Priority country : JP
 JP

(54) DESIGN ASSISTING SYSTEM AND DEVICE THEREFOR

(57)Abstract:

PURPOSE: To accurately and speedily find a design plan meeting customer's requirements by guiding a designing procedure according to a restricted propagation order determination and procedure guide.

CONSTITUTION: The device consists of a design data control part 101, a designing procedure guide part 107, and a designing operation execution part 112, and the designing procedure corresponding to various customer's request patterns is automatically decided based on the restrictions of attribute values of products and automatically generated to calculate a design solution with efficiency. When the design plan is corrected because of corrected propagation due to a change in attribute value or when a contradiction is generated in the propagation of the restrictions, a contradiction eliminating method is shown and if the contradiction can not be eliminated, the restrictions are relaxed to generate a substitute design plan. Further, necessary input attribute values are shown by question generation to enable the user to easily carry on the design.



LEGAL STATUS

[Date of request for examination]

28.10.1998

[Date of sending the examiner's decision of rejection]

10.04.2001

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

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[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

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CLAIMS

[Claim(s)]

[Claim 1] The attribute model which expressed the design specification of a product as a set of an attribute item and attribute value, A model storage means for a design to store the constraint knowledge which expressed the related regulation between each attribute item declaratively, And in case a user inputs requirement specification, the input of attribute value is guided. The engineering-data-management section which consists of design proposal display means to display a design proposal, based on the attribute value set as this attribute model as a result of an input guide means to set the inputted value as this attribute model and an input, or inference/operation, The constraint which can be fulfilled is discovered based on an attribute item and constraint knowledge. [finishing / a value setup in this attribute model] When conflict of attribute value is produced in the middle of a constraint propagation execution sequence decision means to determine the execution sequence of constraint, and a design The design-procedure flare part which consists of procedure guide means to perform guidance for easing the attribute value modification approach for canceling conflict according to the setting situation of the attribute value in this attribute model, or constraint, and generating a substitute design proposal, Take out the constraint it was determined that will perform by this design-procedure flare part from this model storage means for a design, and it is fulfilled. a partial constraint propagation means to set the computed attribute value as this attribute model — and A candidate solution generation means to generate two or more design proposals which satisfy this constraint knowledge when each attribute item has two or more candidate values, And the design actuation activation section which consists of conflict detection means to detect conflict between attribute value from this constraint knowledge is provided. The design exchange method which the attribute value related while following constraint is serially set up according to the inputted attribute item, is in the middle of a design, and is characterized by the ability to determine the design specification of a product efficiently by showing the cure according to a design situation when conflict occurs.

[Claim 2] A means or or by which the value set as each attribute item in the above-mentioned attribute model judges [to which it is newly set] whether a correction setup is carried out, And a means to judge in which constraint it was contradictory when conflict occurred between attribute value is formed in this engineering-data-management section. The new constraint propagation execution sequence decision which determines the execution sequence of constraint propagation according to the attribute item to which the value was set newly based on the data and the constraint knowledge of a design situation which are acquired by these judgment means, When correcting the attribute item to which the value is already set, the correction propagation execution sequence decision which determines the correction sequence of other attribute value associated by constraint The design exchange method according to claim 1 characterized by providing the function changed and performed according to a design situation for the constraint propagation execution sequence decision means of this design-procedure flare part.

[Claim 3] a design exchange method [be / in the suitable design procedure which agreed to a demand by compare the weight of the constraint which compete and perform more important constraint preferentially

when the weight data which express significance to each attribute item and the constraint store in the model storage means for a design of this engineering data management section according to claim 1 add , respectively and two or more constraint which can fulfill exist in the case of the constraint propagation execution sequence decision of this design procedure flare part / it / generable] .

[Claim 4] The weight data which express significance to each attribute item and constraint which are stored in the model storage means for a design of this engineering-data-management section according to claim 1 are added, respectively. Two or more constraint which can be fulfilled exists in the case of the constraint propagation execution sequence decision of this design-procedure flare part. And the design exchange method which can generate the suitable design procedure which agreed in the demand by comparing weight of the attribute item relevant to each constraint, and performing preferentially constraint which can set up a more important attribute item when the weight of the constraint which competes is the same.

[Claim 5] The design exchange method which enables generation of the design procedure according to various demand patterns by adding the design strategy-management means which registers two or more weight data showing each attribute item mentioned above and the significance for every constraint, reads weight data according to a demand pattern, and is assigned to an attribute and constraint, and a means by which a user chooses a demand pattern to this engineering-data-management section.

[Claim 6] By setting to a design exchange method according to claim 1, and providing the attribute lock and unlocking setting up function which enable a setup of locking and unlocking a value for every attribute item in an attribute model in the attribute value input guide means of this engineering-data-management section It is the design exchange method characterized by making generable the design proposal which satisfies requirement specification by not making a value change during design actuation activation about the attribute value which requires modification refusal among requirement specification.

[Claim 7] The design exchange method characterized by to provide the question generation function which determines the attribute item which should input a value and is asked to a user among undecided attribute value in the procedure guide means of this design-procedure flare part in order to continue constraint propagation in a design exchange method according to claim 1, when there is no constraint in which propagation activation is possible.

[Claim 8] The design exchange method characterized by providing the constraint relaxation function for easing constraint and generating a substitute design proposal when the design solution with which are satisfied of constraint is not acquired in a design exchange method according to claim 1 in the procedure guide means of this design-procedure flare part.

[Claim 9] The value set as the attribute item in the model for a design in the design exchange method according to claim 1, When two or more combination is in the attribute value to which the value carried out inference/operation of a value to the undecided attribute item using the data and the constraint knowledge of a design situation, The design exchange method characterized by providing the candidate solution generation means which display inference/result of an operation based on constraint or it narrows down a candidate automatically, and a user is made to choose a value by the interactive mode, and narrows down a candidate in design actuation activation circles.

[Claim 10] In generation of the design proposal to input attribute value or modification of the attribute value in the middle of a design, and generating of conflict, in a design exchange method according to claim 1, a required attribute set and a constraint set are changed according to product structure. The design exchange method characterized by the ability to follow like the design fault from which product structure changes by providing the model change function for a design which changes automatically the attribute model and constraint knowledge for [which is used for generation of a design proposal] a design.

[Claim 11] The design exchange method which makes construction of the model for a design easy by setting to a design exchange method according to claim 1, and providing further the design modern-construction section which consists of the attribute modern construction and the modify feature which registers and corrects an attribute item and an attribute item value, and the constraint knowledge registration and the modify feature which register [constraint and] the knowledge of procedure know-how and are corrected.

[Claim 12] Design exchange equipment which has a design exchange method according to claim 1, and performs drawing output and arrangements based on this result.

[Claim 13] Computer-aided design which can perform an order-received specification design by the processing which cooperated by consisting of file servers which share two or more design exchange equipments with which it has a design exchange method according to claim 1, and data, storing a result in a file server in the middle of an order-received specification design, and being able to refer to from each

design exchange equipment.

[Claim 14] Computer-aided design which makes it possible to carry out an inquiry to a works side when it consists of networks which connect two persons with two or more design exchange equipments which have a design exchange method according to claim 1, and the design exchange equipment of works and special requirement specification is inputted in an order-received specification design.

[Claim 15] Computer-aided design which makes it possible to consist of networks which connect two persons with two or more design exchange equipments which have a design exchange method according to claim 1, and the design exchange equipment of works, and to register and change the knowledge of the model for a design in this design exchange equipment from a works side.

[Claim 16] In a design exchange method according to claim 1, when a user inputs requirement specification, the attribute name column and the attribute value column are indicated by list. If one attribute value column is chosen as a user, a value with this selectable attribute value will be displayed as an alphabetic character or a drawing menu. The attribute value input and the display screen which guides the input of attribute value and displays the attribute value set as this attribute model as a result of inference/operation, And the activation command menu display screen which displays the command menu for starting inference activation, And the interactive mode design exchange method characterized by consisting of the design proposal display screens which generate the configuration data of the model for a design and display a design proposal based on the attribute value of the activation result of inference, and being able to check easily the input of a user's requirement specification, and the design specification of the product determined by inference.

[Claim 17] The interactive-mode design exchange method carry out that a user can check a constraint propagation activation situation by tracing the activation situation of constraint propagation and providing the function display the inference activation trace screen displayed in order of the decision of attribute value, in the partial constraint propagation activation means of the design actuation activation section in an interactive-mode design exchange method according to claim 16 as the description.

[Claim 18] The value set as the attribute item in the model for a design in the interactive mode design exchange method according to claim 16, As a result of a value's performing inference/operation of a value to an undecided attribute item using the data and the constraint knowledge of a design situation, when combination is among two or more attribute value, in order to scold a candidate The design exchange method characterized by providing the function which displays the attribute value selectable combination screen as which a user is made to choose combination by the interactive mode in design actuation activation circles.

[Claim 19] the interactive mode design exchange method carry out whether a design proposal be fill a design basis by check all constraint of the gestalt of the inequality showing a design basis , and provide the function which display in the design proposal evaluation result screen which display a check result in the conflict detection means of the design actuation activation section after perform a constraint propagation and determine attribute value in an interactive mode design exchange method according to claim 16 , and that it check in a user as the description .

[Claim 20] When conflict occurs in an interactive mode design exchange method according to claim 16 while performing constraint propagation, By providing the function which displays the conflict generating message screen which carries out the message indicator of the contents of constraint which interrupted constraint propagation activation and were contradictory in the partial constraint propagation activation means of the design actuation activation section The interactive mode design exchange method characterized by the ability of a user to check where [of a design] a problem is, without continuing useless constraint propagation after conflict generating.

[Claim 21] The interactive mode design exchange method characterized by providing the function which displays the cure planning screen which directs the attribute value modification approach for canceling conflict in the procedure guide means of a design-procedure flare part in an interactive mode design exchange method according to claim 16 when conflict occurs while performing constraint propagation.

[Claim 22] The design exchange method characterized by providing the function which displays the contents of the constraint relaxation for easing constraint and generating a substitute design proposal when the design solution with which are satisfied of constraint is not acquired in an interactive mode design exchange method according to claim 16 in the procedure guide means of this design-procedure flare part.

[Claim 23] The interactive-mode design exchange method characterized by to provide the function which displays the question generation screen which determines the attribute item which should input a value and is asked to a user among undecided attribute value in the procedure guide means of a design-procedure

flare part in order to continue constraint propagation in an interactive-mode design exchange method according to claim 16, when there is no constraint in which propagation activation is possible.

[Claim 24] In an interactive mode design exchange method according to claim 16, when two or more combination with selectable attribute value occurs in the middle of inference the inference mode (sequential selection) in which processing to which an attribute value selectable combination screen is serially displayed, and selection is demanded from a user is performed — or without displaying Hold as a candidate value to the range of each attribute in an attribute model, and inference is continued. By preparing the control panel screen which displays the inference mode selection menu which can choose whether it is in inference mode (candidate maintenance) in which processing which displays a color for the candidate value in the menu of the attribute value of an attribute value input and the display screen in distinction from the inference termination back is performed The interactive mode design exchange method characterized by the ability of a user to choose an inference executive operation pattern.

[Claim 25] In the control panel screen of an interactive mode design exchange method according to claim 24 By providing the demand pattern No. selection menu which can choose various design demands of a user The design strategy-management means of this engineering-data-management section the significance of an attribute and constraint corresponding to demand pattern No. The interactive mode design exchange method which generates the suitable design procedure which read from the data of the significance registered for every demand pattern to each attribute item and constraint, set significance as an attribute item and constraint, determined the constraint propagation execution sequence based on this significance, and agreed in various demands of a user.

[Claim 26] In the control panel screen of an interactive mode design exchange method according to claim 24 By providing the demand pattern No. selection menu which can choose various design demands of a user The design strategy-management means of this engineering-data-management section the significance of an attribute and constraint corresponding to demand pattern No. The interactive mode design exchange method which generates the suitable design procedure which read from the data of the significance registered for every demand pattern to each attribute item and constraint, set significance as an attribute item and constraint, determined the constraint propagation execution sequence based on this significance, and agreed in various demands of a user.

[Claim 27] The interactive mode design exchange method characterized by selection becoming possible about the case where a user wants to check an inference activation situation in the control panel screen of an interactive mode design exchange method according to claim 24 by preparing preservation / un-saving and the display of an inference activation trace screen / non-display selection menu, and the case where the need does not exist. [of design hysteresis information]

[Claim 28] The interactive mode design exchange method with which the case where input guidance of attribute value is required, and a user are characterized by selection becoming possible about the case where it is not necessary to be input guidance in an expert by the user by the beginner in the control panel screen of an interactive mode design exchange method according to claim 24 by preparing the menu which carries out the selection menu of a display / un-displaying when inputting attribute value. [of a drawing menu]

[Claim 29] In the attribute value input and the display screen of an interactive mode design exchange method according to claim 16 Because the value set as each attribute item in the above-mentioned attribute model judges whether it is the value which inputted or was set up by whether it is a default value and inference which is a user and distinguishes and displays a color The interactive mode design exchange method characterized by preparing the attribute value classification-by-color display function to which a user can check easily the basis which attribute value determined.

[Claim 30] In the attribute value input and the display screen of an interactive mode design exchange method according to claim 16 The function which classifies an attribute item for every configuration equipment of the model for a design, makes this classification a header entry, and indicates by list, If a user chooses a header entry, only the attribute name column of the range of the selected header entry, and the attribute value column to an attribute value input and the display screen by the function which indicates by list The interactive mode design exchange method characterized by preparing the header-entry list menu which enables the attribute which a user wants to input to discover easily even if the number of attribute items increases.

[Claim 31] The interactive-mode design exchange method characterized by the ability of a user to be able to judge easily whether a design is the middle by preparing the function which distinguishes and displays the color of a header entry in the header-entry list menu of an interactive mode design exchange method according to claim 30 by the case where all the attribute value of the range of each header entry is

decision settled, and the case where at least one attribute value is undecided, or total attribute value has been determined and completed.

[Claim 32] The interactive design exchange method characterized by indicating the range to inequality by the menu in the attribute value input and the display screen of an interactive mode design exchange method according to claim 16 when the mold of attribute value is a numerical attribute.

[Claim 33] In the attribute value input and the display screen of an interactive mode design exchange method according to claim 16 By providing the attribute lock and the unlocking setting column which enable a setup of locking and unlocking a value for every attribute item in an attribute model, among requirement specification About the attribute value as which a user demands modification refusal of the value under inference The interactive mode design exchange method characterized by making generable the design proposal which satisfies requirement specification by being locked if the lock/unlocking column of the attribute item is clicked, not changing the attribute value locked during design actuation activation, but changing other attribute value.

[Claim 34] The interactive mode design exchange method characterized by the ability to cancel a lock demand easily by returning to an unlocking condition and making a change possible by clicking again the lock/unlocking column of the locked attribute value in the attribute lock of the attribute value input and the display screen of an interactive mode design exchange method according to claim 16, and the unlocking setting column.

[Claim 35] In the activation command menu display screen which displays the command menu for starting inference activation of an interactive mode design exchange method according to claim 16 The procedure guide command menu which performs the guidance function of the procedure which eases constraint and generates a substitute design proposal or it directs the attribute value modification approach when conflict occurs in the middle of a design, The examination Fig. display command menu which performs a design proposal display based on the attribute value determined after inference activation, The interactive mode design exchange method characterized by the ability of the function which a user wants to perform by preparing the control panel command menu which carries out the calling indicator of the control panel screen which set up inference mode, and a shutdown command menu to choose easily.

[Claim 36] In the attribute value input and the display screen of an interactive mode design exchange method according to claim 16 If the attribute value about the basic structure of expressing the configuration pattern of the model for a design is inputted The configuration data of the knot scale beforehand registered for every configuration pattern Search as a key, and when the function which displays this input attribute value, and a user click the attribute name column of an attribute value input and a display screen, each attribute item in the above-mentioned attribute model It has to which dimension of the configuration of the model for a design it corresponds, and the function which judges and displays the dimension line for a configuration and a color in distinction from a knot scale Fig. top. The interactive mode design exchange method characterized by preparing the knot scale Fig. display function for an attribute value input to which a user can check easily the contents of the attribute which it is going to input.

[Claim 37] In an interactive mode design exchange method according to claim 16, by the function which displays inference activation and a procedure guide command menu on coincidence as an attribute value input and the display screen, and the knot scale drawing side for an attribute value input or the design proposal display screen While being able to compare the contents of the attribute value which the user inputted, and the design proposal generated based on the inputted attribute value and being able to perform evaluation to a user's design proposal easily The interactive mode design exchange method characterized by the ability to choose a procedure guidance selection menu immediately and operate a cure easily when there is a problem.

[Claim 38] Generation of a design proposal [on an interactive mode design exchange method according to claim 16 and as opposed to input attribute value], Or so that the model change function for a design may become with a required attribute set and a constraint set according to product structure in modification of the attribute value in the middle of a design, and generating of conflict After changing automatically the attribute and constraint knowledge of the model for a design which are used for generation of a design proposal, the list after the change of the attribute name column and the attribute value column is displayed. By providing the function which displays the selectable value after the change of this attribute value as an alphabetic character or a drawing menu, if one more attribute value column is chosen as a user The interactive mode design exchange method characterized by the ability to input attribute value to which the user was able to take adjustment also when product structure changed.

[Claim 39] When a user wants to create a design proposal to new housings at the time of starting of this

interactive mode design exchange method in an interactive mode design exchange method according to claim 16, By providing the function which displays new / registered housing data selection screen which can choose employment of a system according to the case where he wants to correct the design proposal of the already created housing in the input guidance means of the engineering-data-management section The interactive mode design exchange method characterized by the ability of a user to choose for the employment purpose.

[Claim 40] The interactive-mode design exchange method the model for a design can build easily by setting to an interactive-mode design exchange method according to claim 16, and providing further the design modern-construction section which consists of the function which displays the attribute modern construction and the correction screen which registers and corrects an attribute subject name and an attribute item value, and the function which display constraint knowledge registration / correction screen which registers [constraint and] the knowledge of procedure know-how and corrects.

[Claim 41] The attribute model which is the design-specification item of a product in a design exchange method according to claim 1, A model storage means for a design to store the constraint knowledge which is a related regulation between each attribute item, and the product structure knowledge of defining a required attribute set and a constraint set according to product structure, The design-strategy knowledge which registers two or more each attributes and weight data for every constraint for every demand pattern of a customer, and cure know-how when conflict of attribute value arises in the middle of a design are provided. And with an input guide means It is based on product structure knowledge to the attribute value over product structure among the requirement specification which the user inputted. Among the attribute in the model storage means for a design, and constraint By providing the model change means which changes the activated state of constraint knowledge to the attribute set used for generation of a design proposal It can respond to a structural change, and the weight data in design-strategy knowledge are read according to a customer's demand pattern No. which the user inputted, and each attribute and the design strategy-management means assigned to constraint are provided, And a constraint extract means which can be started to extract the constraint which can be started based on an attribute item and constraint knowledge, [finishing / a value setup in this attribute model] By providing a starting constraint judging means to judge the constraint which fulfills large constraint of significance preferentially among two or more extracted constraint which can be fulfilled, based on the weight data assigned to each constraint and an attribute The design procedure according to various customers' demand pattern is generable, and when conflict of attribute value is produced in the middle of a design By providing a procedure guide means to perform advice for generating a substitute design proposal, using the cure know-how about the product structure attribute value modification approach for canceling conflict, the input attribute value modification approach of a demand, or the constraint relaxation approach The design exchange method which can incorporate the know-how of the suitable advice according to the situation of a design and which is characterized by things and can compute a design solution quickly.

[Claim 42] If the attribute value about the basic structure of expressing the configuration pattern of the model for a design is inputted in a design exchange method according to claim 1 A means to search this input attribute value for the configuration data of the knot scale graphic form beforehand registered for every configuration pattern as a key, When a means to display the searched knot scale graphic form, and a user click the attribute name column of a demand attribute value input means, each attribute item in the model for a design It has to which dimension of the configuration of the model for a design it corresponds, and the function which judges and displays the dimension line for a configuration and a color in distinction from a knot scale Fig. top. The design exchange method characterized by establishing a knot scale Fig. display means for an attribute value input by which a user can check easily the contents of the attribute which it is going to input.

[Claim 43] Claim Design exchange method which can build knot scale graphic data easily by providing further a knot scale graphic-data registration means to register knot scale graphic data, graphic data, correspondence of an attribute subject name, and the retrieval conditions of a knot scale graphic form, in the design exchange method of a publication.

[Claim 44] In a design exchange method according to claim 1, the candidate for a design is modeled according to the constraint which exists between an attribute and these attributes. In computer-aided design which acquires a design solution from the value of the attribute including the attribute as which the designer inputted the value based on requirement specification for which the value already became settled by calculating the value of an undecided attribute one after another using a constraint The constraint relaxation means for specifying that a designer eases this constraint when the value including the attribute into which the value was inputted of the attribute for which the value already became settled does not

satisfy a constraint, The design exchange method possessing the constraint management method which prepared the constraint relaxation level storage section which memorizes [which relates with this and came to obtain the result in the middle of the design solution or the design when a result is stored in the middle of a design solution or a design] the relaxation level of each constraint.

[Claim 45] The constraint management method according to claim 44 by which attribute value is set automatically from other design systems instead of a designer inputting attribute value.

[Claim 46] The constraint management method according to claim 44 which makes an automatic decision of the constraint and relaxation level which a system eases instead of specifying the constraint and relaxation level which a designer eases.

[Claim 47] The constraint management method according to claim 44 which has the design intention storing section which memorizes collectively the design intention which eased the constraint with the relaxation level of each constraint.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention is the field of computer software aiming at design exchange. In the process in which the attribute item value of the product which fills a demand of a customer is determined about the product with the variation of various attribute items and attribute value based on constraint It is related with the computer-aided design which has two or more design exchange equipment which has a design exchange method for asking for the design proposal which satisfies a demand, and this, and these design exchange equipments, guiding a procedure for a user, when it opts for a suitable design procedure according to the situation of a design and conflict occurs on the way.

[0002]

[Description of the Prior Art]

The technique of knowledge engineering is applied to a design problem in recent years [<functional>], and if a product is modeled and a designer inputs the value of an attribute based on requirement specification according to the attribute which specifies the candidate for a design (product), and the constraint which exists among these attributes, computer-aided design which obtains a design proposal will have appeared by starting a constraint and deciding the value of an undecided attribute one after another. for example, like a publication in a JP,2-126370,A official report like the relation of input data, such as performance-evaluation items, such as fuel consumption and a radius of gyration, and gear ratio required in order to ask for this The frame which defined the information on an attribute required in order to calculate an attribute required for a design and the attribute value concerned is arranged to a layered structure. Searching for a layered structure with the input or modification of the attribute value of the lowest layer which memorizes design sequencing about each attribute, i.e., a design procedure, from the input attribute with the formula which computes an output attribute, and is defined as input data By extracting the attribute of the related upper layer and setting up a value serially, also to the partial attribute value input and partial modification to which all required input attribute items are not equal, a design procedure, i.e., the configuration procedure and correction procedure of attribute value, is generated efficiently, and a design solution is acquired.

[0003] moreover, as an approach for determining the attribute value of two or more devices which

constitute the candidate for a design using a knowledge based system, and the attribute value of the layout which is arrangement of a device. The constraint knowledge concerning the configuration for a design, and arrangement like a publication in a JP,3-92972,A official report, After searching the candidate location which fills constraint sequentially from the early device of location sequence using the knowledge about the location sequence of each device, and the evaluation knowledge after arrangement and choosing one of two or more candidate locations, the candidate location of the early device of location sequence is searched next by making the selected candidate location into a constraint, and one is chosen. If the candidate location of a device is not found on the way, it backtracks (back track), and the candidate location of the device arranged immediately before is changed, and the changed location is searched for the candidate location of the following device. The design proposal which is satisfied with the location of a complete aircraft machine repeating namely, determining this flow without conflict by all solution retrieval of an attribute value candidate of requirement specification had been obtained.

[0004]

[Problem(s) to be Solved by the Invention]

A <function> Since it expresses procedurally in the forms where it is necessary to define beforehand the attribute item which can be inputted in the phase to arrange design sequencing about each attribute to a layered structure as the lowest layer of a layered structure with the conventional technique given in above-mentioned JP,2-126370,A and, and the constraint which is a related regulation between attributes also computes an output attribute from an input attribute, such as a formula, it is inapplicable to the design which an input attribute cannot assume beforehand. For example, corresponding to two or more demands referred to as "An attribute B wants to calculate an attribute A from this value by known in being another although an attribute A wants to calculate an attribute B from this value by known in a certain case", when there is relation (constraint) to an attribute A and an attribute B called $A=B+\alpha$, since the related regulation of $B=A-\alpha$ and $A=B+\alpha$ cannot be expressed to coincidence, generation of a design procedure cannot be performed. That is, the relation between an input attribute and an output attribute was immobilization, the design procedure could apply this conventional technique only to the clear small-scale problem, but there was a problem that it could not respond in the design with the various demand patterns which an input attribute and an output attribute cannot assume beforehand.

[0005] moreover, with the conventional technique of a publication, to JP,3-92972,A After determining all of the attribute value of two or more devices which constitute the candidate for a design, it arranges sequentially from the early device of location sequence. Whether there is any candidate location of other devices, since it determined the attribute value of a layout, namely, the problem of an equipment selection and a layout has dissociated, searching, Even when a layout is not decided owing to the attribute value of a device, after carrying out the trial of all the solution retrieval processings of a candidate location layout of all There was a problem of taking time amount before being able to obtain the design proposal which it will return and redo to selection of the attribute value of a device for the first time, and back track of a design occurs, and satisfies requirement specification, when a design proposal is not obtained to the last.

[0006] Moreover, although the product structure which are a device, the attribute set of a layout, and a constraint set changed according to this when the structure of a surrounding building where a device was arranged etc. was changed in process of design actuation, by the conventional approach, there was a problem that it could not respond if change of the DS such for a design occurs like a retrieval fault.

[0007] Moreover, since the layout sequence of each device was the flow of immobilization, the contents of the knowledge which met the procedure of a design of the conventional approach could make only the decision of the attribute value according to this sequence, but had the problem that generation of the design procedure of deciding the location sequence of a device according to the situation of a design could not be performed.

[0008] Moreover, when conflict generated knowledge [heuristics / approach / when conflict occurs between attribute value / dissolution] in process of design actuation in a pad for a pile reason, there was a problem that a user redid an input and repeated trial-and-error.

[0009] Moreover, when there was no design proposal which satisfies all constraint, there was a problem that it could not ask for the alternative design proposal which satisfies requirement specification as much as possible.

[0010] Moreover, the layout chose any one for the candidate location of each device, and since it was the approach of exhaustive search of asking for the candidate location of the following device depending on this, it had the problem that it could not ask for the optimal design proposal efficiently.

[0011] Moreover, in order to choose every one value of the candidate of each attribute and to decide the value of other attributes based on the value, neither a device nor two or more candidate design proposals

of a layout could be generated at once, but there was a problem that a user did not understand what kind of design proposal can take as a candidate from the inputted attribute value.

[0012] Moreover, also after performing all possible design operations with the attribute value first inputted as requirement specification, when all attribute value was not decided, if which attribute value was not newly inputted, processing stopped, a design proposal was not called for, but since there was no method of directing which attribute value should be inputted into a user in order to advance a design previously, there was a problem that it was necessary to apply a trial-and-error method.

[0013] It was made in order that the invention in this application might solve the above troubles, and the design procedure according to various demand patterns can generate automatically, a design procedure can guide in the aspect of affairs require decision of users, such as generating of two or more candidates of the attribute value produced in process of design actuation and generating of conflict between attribute value, and it aims at providing the design exchange method which can create a design proposal correctly and quickly.

[0014] <A screen and actuation> It responds to the guidance screen at the time of a user's requirement specification input, and the inputted pattern of various requirement specification again. Automatically a design procedure After generation, In the aspect of affairs of requiring decision of users, such as generating of two or more candidates of the attribute value produced in process of inference and generating of conflict between attribute value By displaying a required prompting message as a dialogue screen, a design procedure can be guided and it aims at offering the design exchange method which can create a design proposal correctly and quickly by the interactive mode.

[0015] As an approach of determining <the block diagram into which the view was changed>, and attribute value, carry out a data drive from the inputted attribute value, and constraint is started. So that it may be satisfied other attribute value The approach by the constraint propagation to determine (G.) [L.Steel] Jr. : The Definition Although there are and Implementation of a Computer ProgrammingLanguage Based on Constraints, AI-TR -595, and MIT (1978) conventionally When applying this approach to the specification decision of a product with constraint and the attribute of a practical use scale, there is a problem in respect of the following.

[0016] 1) Although contention from which constraint the constraint which can usually be started performs by more than one existing to the attribute value which the customer who inputted demands occurs, when it competes, it has not judged from which constraint it performs. That is, the design procedure is not taken into consideration. For this reason, if it performs, for example in order of description of constraint, unimportant constraint starts previously, conflict is sometimes produced in important constraint later, a demand of a customer must be changed, a design must be redone, and the count of trial-and-error of a user will increase.

[0017] 2) Even when performing the constraint propagation which took the design procedure into consideration about 1, there is a number pattern with which the relation of the attribute value which a customer demands, and the attribute value which should be outputted as an inference result of it completely differs, and a design procedure may become completely reverse depending on a pattern. Therefore, since the execution sequences of the constraint which competes and which can be started differ according to a customer's demand pattern, the structure which changes an execution sequence according to a demand pattern for opting for a suitable design procedure is required for them.

[0018] 3) For [one] a design, there is usually that how many kinds of variety in structure, and the attribute set and constraint set which express an object product with this pattern may differ from each other. However, by the approach of the conventional constraint propagation, when the change of constraint and an attribute occurs on the way, it does not correspond.

[0019] 4) When conflict occurs in the middle of constraint propagation, the efficient dissolution approach cannot be guided. The expert grasps the qualitative interaction of each attribute as the constraint network which is the correspondence relation of constraint showing the relation between attributes from the past experience, and it has the cure know-how which attribute should be changed or which constraint should be eased. Then, the structure which can use know-how is required at the time of conflict generating of constraint propagation.

[0020] Moreover, constraint is expressed in the form of the first floor predicate logic, and language, such as constraint logic programming operated by the PROLOG language processing system, is developed. However, although the designer for a design inputs five constraint and it has the knowledge for a design, the knowledge of language description is not enough in many cases. Therefore, making constraint describe in the format of language avoids if possible, and it needs to enable it for expressions, such as the table of engineering data and equality which a designer uses, and inequality, to describe constraint.

[0021] 6) Fundamentally, this language processing system carries out all solution retrieval by the depth first, and discovers a solution. Therefore, it is in the middle of retrieval, and in order to repeat retrieval until it backtracks and can take adjustment when conflict is generated, after starting processing before the reply of a system returns, it takes time amount. In the case of the computer-aided design of an interactive mode, the case where he wants to change a demand when conflict is generated can be considered, but it cannot change until it carries out all solution retrieval and finishes it as this art.

[0022] 7) It is not suitable when you want to calculate the solution a user is satisfied with an interactive mode of a solution since it means that only the variation of a change of the scale of a search tree in this processor had increased when the change of the attribute set which expresses the candidate for a design like 3, or a constraint set occurred on the way, combination explosion arises and a search time starts very much.

[0023] For the specification of the device which constitutes for [aiming at offering the design exchange method which can respond to the above-mentioned trouble and can create a quick design proposal / <the knot scale graphic form for an input>, and for a design] from this invention, and the attribute about arrangement After the approach a user inputted the value which a customer demands extracted the location and value of a dimension to demand and investigated the attribute subject name corresponding to this out of the drawing by the side of a customer, on the attribute value input screen, the user found this attribute subject name and it had inputted the value. Moreover, when a design proposal is not obtained to the last, in order for back track of a design to occur and to change requirement specification, attribute value needed to be inputted again, the count which will read the dimension on a drawing by the time it can obtain the design proposal to satisfy, and is inputted into attribute value increased, and there was a problem that an entry of data took time amount.

[0024] It is what was made in order that this invention might solve the above troubles. If the attribute value about the basic structure of expressing the configuration pattern of the model for a design is inputted, by displaying the knot scale graphic form corresponding to a pattern When a user clicks the attribute name column of a demand attribute value input means, each attribute item in the model for a design When a user can check easily the contents of the attribute which is going to have the function which judges and displays the dimension line for a configuration and a color in distinction from a knot scale Fig. top, and is going to input to which dimension of the configuration of the model for a design it corresponds A design procedure can be guided and it aims at offering the design exchange method which can input a design data quickly.

[0025] <Constraint management method> Although it considers using a standard component, the standard manufacturing method, etc. as much as possible first in the usual product design, requirement specification is severe, and when [some] a design solution cannot be found out, even if it takes cost and a period, by the standard component or the standard manufacturing method, a designer thinks in the sequence of examining using a nonstandard component and the special manufacturing method again. Therefore, it divides into the non-standard constraint which considered the standard-in constraint constraint on condition of a standard component, the standard manufacturing method, etc., the nonstandard component, and the special manufacturing method when the system which supports such a design using constraint was considered, and describes, and first, when only standard constraint is confirmed, a design is advanced and it is generated in conflict, it is necessary to take the approach of carrying out sequential relaxation in a constraint, to non-standard constraint. At this time, it is called constraint relaxation level to which constraint it eased.

[0026] However, since consideration of is not made the case where the design solution to is used, when resuming a design after interrupting a design temporarily, performing another design or stopping a system, or when taking over a design to its another post in the middle of a design, Decision making made on the occasion of the design which drew the result in the middle of the design solution or a design when the design was resumed, The contents of decision disappear, namely, the conflict which does not satisfy constraint between the values of the attribute of a result in the middle of a design solution or a design since the constraint which the information on which constraint was eased to which relaxation level disappeared, and was eased becomes again effective is detected. There was a problem that the contents of the conflict had to be examined again.

[0027] When the purpose of this invention abolishes the above-mentioned trouble, and correct a design solution or continuing a design using a result in the middle of a design solution or a design, correct a design solution or it is [which came to obtain a result in the middle of the design solution or a design] for providing using the eased constraint about the design exchange method provide a constraint management method which becomes possible [continuing a design].

[0028] The inference approach described by the <candidate solution generation> above is an approach of carrying out sequential execution of the constraint which can be started, and determining undecided attribute value from the inputted attribute value, and is an approach of calculating efficiently one design solution with which are satisfied of a demand. However, there is a case where he wants to know all the design solutions with which it is satisfied of a demand depending on a demand of a customer.

[0029] It is in offering the design exchange method possessing a candidate solution generation means to calculate all the design solutions that are satisfied with this invention of the inputted attribute value using constraint and an attribute.

[0030]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, the design exchange method by this invention is considered as the configuration which prepares the engineering-data-management section, the design actuation activation section, and a design-procedure flare part. Namely, the attribute item for a design, the attribute model which stores attribute value, and the model storage means for a design which consists of the constraint knowledge which stores constraint between attribute items, An input guide means to guide selection of a value at the time of a requirement specification input, and to set the inputted value as an attribute model, The engineering-data-management section which consists of design proposal display means to output a design proposal, based on the attribute value set as the attribute model as a result of an input, or inference/operation, A partial constraint propagation means by which a value performs inference/operation to an undecided attribute item using the value set as the attribute item in the model for a design, A candidate solution generation means to reason/calculate the combination of each attribute value and the range of a value with which are satisfied of constraint, and to ask coincidence for them when the range of two or more candidate values or a value is in each attribute value, The design actuation activation section which consists of a conflict detection means to check the adjustment between attribute value, Furthermore, the model for a design generates the network of each attribute and constraint. A constraint propagation execution sequence decision means to determine the execution sequence of constraint propagation respectively when attribute value [finishing / a setup / already] when a demand is inputted using this constraint network is changed, It is in the middle of a design, and when conflict occurs, the design-procedure flare part which consists of procedure guide means to direct the constraint relaxation approach for easing the attribute value modification approach for canceling this conflict or constraint, and generating a substitute design proposal is prepared.

[0031] By the design exchange method by this invention, a device and the data about the specification of a layout Moreover, an attribute item, And the constraint to which the causal relation between attributes is expressed on the equality between attribute items, inequality, and a table, Since it can determine while the decision procedure of a specification can be systematically expressed as decision sequence of the attribute value by the constraint propagation on a constraint network and attribute value carries out the constraint propagation of the constraint network top in both directions After determining all devices, it is not necessarily necessary to determine a layout, and a more nearly reversible design is enabled. Moreover, since generation of the constraint network which is matching between next attributes only in a user adding an attribute and constraint is performed by design exchange equipment and the relation between two or more flat surfaces is also included all over a constraint network, the design proposal in consideration of this is generable.

[0032] Moreover, it carries out following a dynamic change of product structure, choosing the suitable model for a design automatically, and continuing a design by the model change function for a design which makes automatic selection of the model for a design used for generation of a design proposal by the design exchange method by this invention corresponding to modification in the middle of a design corresponding to the inputted requirement specification, as it is possible.

[0033] Moreover, by the design exchange method by this invention, neither a layout nor each attribute value of a device performs exhaustive search according to the order of description of knowledge like unification. With the data of a design situation showing whether conflict is occurring between the inputted attribute value, and control flags, such as lock/unlocking assignment to attribute value, and whether each attribute value was newly set up or a correction setup was carried out and attribute value An execution sequence will be determined, if the constraint which can be started on a constraint network is discovered serially and there is constraint in which two or more startings are possible. Design actuation on the way So that related constraint may not be contradictory, when modification is added to attribute value [finishing / a setup / already] With a constraint propagation execution sequence decision means to determine the execution sequence of the correction propagation which corrects other related attribute value one after another, automatic generation of the design procedure for determining attribute value efficiently according

to various requirement specification is enabled.

[0034] Moreover, by the design exchange method by this invention, in case an above-mentioned constraint propagation execution sequence decision is made When two or more constraint which should be started exists, the weight data showing the significance beforehand assigned to each attribute item and constraint are referred to. Compare weight of the constraint which competes and perform more important constraint preferentially. Moreover, since a constraint execution sequence and a direction can be controlled by comparing weight of the attribute item relevant to each constraint, and performing preferentially constraint which can set up a more important attribute item when the weight of the constraint which competes is the same The suitable design procedure corresponding to a demand pattern is made generable.

[0035] Moreover, automatic generation of a design procedure according to various demand patterns is enabled by using the design strategy-management means which registers two or more weight data which express with the design exchange method by this invention each attribute item mentioned above and the significance for every constraint, reads weight data according to a demand pattern, and is assigned to an attribute and constraint, and a means by which a user chooses a demand pattern.

[0036] Moreover, by the design exchange method by this invention, conflict occurs in process of design actuation. The conflict dissolution function which shows the specification modification approach based on the heuristics knowledge experientially stored about the conflict dissolution approach when there is no design proposal which satisfies all constraint, After performing the part in which a design operation is possible with the attribute value inputted as the constraint relaxation function to ask for the alternative design proposal which eases constraint currently used for generation of a design proposal, and satisfies requirement specification as much as possible, as requirement specification If which attribute value is newly inputted when all attribute value is not decided It calculates whether constraint propagation is carried out and most other undecided attribute value can be determined, and with the procedure guide means which consists of a question generation function it is directed to a user that inputs the attribute value, the count of the trial-and-error which a user performs is decreased, and an efficient design is enabled.

[0037] Moreover, the candidate design proposal which is the combination of attribute value and the range of a value it is satisfied with the design exchange method by this invention of the range from these interrelations in consideration of two or more constraint on a constraint network at coincidence when the range of a device, the candidate value of the attribute of a layout, or a value occurs by constraint is generated. Or whenever the candidate value of an attribute occurs during constraint propagation, display a candidate value serially, a user is made to choose a value, and what can be judged with a candidate solution generation means to decide other attribute value by constraint propagation about the value after seeing two or more possible design proposals to requirement specification is made possible.

[0038] Moreover, it is design exchange equipment which has a design exchange method by this invention, calculates a design solution, and performs drawing output and arrangements.

[0039] Moreover, it is the computer-aided design which can perform processing which cooperated because it consists of file servers which share two or more design exchange equipments with which it has a design exchange method by this invention, and data, a result is stored in a file server in the middle of a design and it can refer to from each design exchange equipment.

[0040] Moreover, it is the computer-aided design which is constituted by the network which connects two persons with two or more design exchange equipments which have the design exchange method installed in the business by this invention, and the design exchange equipment installed in works, carries out an inquiry from business to the designer of works, obtains quickly on-line in a reply when special requirement specification is advanced from a customer in a design, and can create in a design proposal.

[0041] Moreover, it is constituted by the network which connects two persons with two or more design exchange equipments which have the design exchange method installed in the business by this invention, and the design exchange equipment installed in works, and is the computer-aided design which can register the knowledge of the model for a design in the design exchange equipment by the side of business, and can change from the design exchange equipment by the side of works.

[0042] Moreover, the design exchange method by this invention the above and the processing which the engineering-data-management section, the design actuation activation section, and a design-procedure flare part perform so that it may be advanced by dialogue actuation with a user When a user inputs requirement specification, the attribute name column and the attribute value column are indicated by list. If one attribute value column is chosen as a user, a value with this selectable attribute value will be displayed as an alphabetic character or a drawing menu. The attribute value input and the display screen which guides the input of attribute value and displays the attribute value set as this attribute model as a result of

inference/operation, The activation command menu display screen which displays the command menu for starting inference activation, Based on the attribute value of the activation result of inference, it constitutes from the design proposal display screen which generates the configuration data of the model for a design and displays a design proposal, and enables it to check easily the input of a user's requirement specification, and the design specification of the product determined by inference.

[0043] Moreover, it enables it for a user to check a constraint propagation activation situation by the design exchange method by this invention tracing the activation situation of constraint propagation, and providing the function to display the inference activation trace screen displayed in order of the decision of attribute value, in the partial constraint propagation activation means of the design actuation activation section.
 [0044] Moreover, the value with which the design exchange method by this invention was set as the attribute item in the model for a design, when two or more combination is in the attribute value to which the value carried out inference/operation of a value to the undecided attribute item using the data and the constraint knowledge of a design situation, the function which displays an attribute value selectable combination screen is provided in design actuation activation circles — "be alike rattlingly" A user is made to choose combination by the interactive mode, and it enables it to scold a candidate.

[0045] Moreover, after the interactive-mode design exchange method by this invention performs constraint propagation and attribute value determines it, it enables it whether a design proposal is filling a design basis and to check in a user by checking all constraint of the gestalt of the inequality showing a design basis, and providing the function display the design proposal evaluation result screen which displays a check result, in the conflict detection means of the design actuation activation section.

[0046] Moreover, when conflict generates the design exchange method by this invention while performing constraint propagation, By providing the function which displays the conflict generating message screen which carries out the message indicator of the contents of constraint which interrupted constraint propagation activation and were contradictory in the partial constraint propagation activation means of the design actuation activation section A user enables it to check where [of a design] a problem is, without continuing useless constraint propagation after conflict generating.

[0047] Moreover, the interactive mode design exchange method by this invention guides a design procedure by providing the function which displays the cure planning screen which directs the attribute value modification approach for canceling conflict in the procedure guide means of a design-procedure flare part, when conflict occurs while performing constraint propagation.

[0048] Moreover, when the design solution with which are satisfied of constraint is not acquired, it enables it for the design exchange method by this invention to obtain the design proposal near a demand of a user by providing the function which displays the contents of the constraint relaxation for easing constraint and generating a substitute design proposal in the procedure guide means of this design-procedure flare part.

[0049] Moreover, when there is no constraint in which propagation activation is possible, in order that the design exchange method by this invention may continue constraint propagation, it enables it to carry out the design without leakage by determine the attribute item which should input a value among undecided attribute value, and provide the function which displays the question generation screen ask to a user in the procedure guide means of a design-procedure flare part.

[0050] Moreover, when two or more combination with selectable attribute value occurs in the middle of inference, the design exchange method by this invention the inference mode (sequential selection) in which processing to which an attribute value selectable combination screen is serially displayed, and selection is demanded from a user is performed — or without displaying Hold as a candidate value to the range of each attribute in an attribute model, and inference is continued. By preparing the control panel screen which displays the inference mode selection menu which can choose whether it is in inference mode (candidate maintenance) in which processing which displays a color for the candidate value in the menu of the attribute value of an attribute value input and the display screen in distinction from the inference termination back is performed A user enables it to choose an inference executive operation pattern.

[0051] Moreover, the design exchange method by this invention is set on the aforementioned control panel screen. By providing the demand pattern No. selection menu which can choose various design demands of a user The design strategy-management means of this engineering-data-management section the significance of an attribute and constraint corresponding to demand pattern No. It reads from the data of the significance registered for every demand pattern to each attribute item and constraint, significance is set as an attribute item and constraint, a constraint propagation execution sequence is determined based on this significance, and generation of the suitable design procedure corresponding to various demands of a user is enabled.

[0052] Moreover, it is made for selection of the design exchange method by this invention to be attained in

the aforementioned control panel screen about the case where a user wants to check an inference activation situation, and the case where the need does not exist, by preparing preservation / un-saving and the display of an inference activation trace screen / non-display selection menu. [of design hysteresis information]

[0053] Moreover, in the aforementioned control panel screen, by preparing the menu which carries out the selection menu of a display / un-displaying, users are [the case where input guidance of attribute value is required, and a user] experts in a beginner, and the interactive mode design exchange method by this invention makes selection possible about the case where there is no need for input guidance, when inputting attribute value. [of a drawing menu]

[0054] Moreover, a user enables it to check easily the basis which attribute value determined by the design exchange method by this invention having judged whether the value set as each attribute item in an attribute model was a value which inputted or was set up by whether it is a default value and inference which is a user in aforementioned attribute-value input and display screen, and having prepared the attribute-value classification-by-color display function which distinguishes and displays a color.

[0055] Moreover, the design exchange method by this invention is set to the aforementioned attribute value input and display screen. The function which classifies an attribute item for every configuration equipment of the model for a design, makes this classification a header entry, and indicates by list, By having prepared the header-entry list menu with the function which indicates only the attribute name column of the range of the selected header entry, and the attribute value column by list in an attribute value input and the display screen, when the user chose the header entry Even if the number of attribute items increases, the attribute which a user wants to input makes it possible to discover easily.

[0056] Moreover, when the design exchange method by this invention prepares the function which distinguishes the color of a header entry in the aforementioned header-entry list menu by the case where all the attribute value of the range of each header entry is decision settled, and the case where at least one attribute value is undecided, and displays, a user enables it to judge easily whether a design is the middle or total attribute value is determined and completed.

[0057] Moreover, in the aforementioned attribute value input and display screen, when the mold of attribute value is a numerical attribute, the design exchange method by this invention is indicating the range to inequality by the menu, and guides the range which a user should input.

[0058] Moreover, the design exchange method by this invention is set to the aforementioned attribute value input and display screen. By providing the attribute lock and the unlocking setting column which enable a setup of locking and unlocking a value for every attribute item in an attribute model, among requirement specification About the attribute value as which a user demands modification refusal of the value under inference It will be locked if the lock/unlocking column of the attribute item is clicked, and the design proposal which satisfies requirement specification is made generable by not changing the attribute value locked during design actuation activation, but changing other attribute value.

[0059] Moreover, the design exchange method by this invention enables it to cancel a lock demand easily by returning to an unlocking condition and making a change possible by clicking again the lock/unlocking column of the locked attribute value in the attribute lock of the aforementioned attribute value input and display screen, and the unlocking setting column.

[0060] Moreover, the design exchange method by this invention is set to the activation command menu display screen which displays the command menu for starting inference activation. The procedure guide command menu which performs the procedure guide function which eases constraint and generates a substitute design proposal or it directs the attribute value modification approach when conflict occurs in the middle of a design, The examination Fig. display command menu which performs a design proposal display based on the attribute value determined after inference activation, The function which a user wants to perform enables it to choose easily by preparing the control panel command menu which carries out the calling indicator of the control panel screen which set up inference mode, and a shutdown command menu.

[0061] Moreover, the design exchange method by this invention is set to the aforementioned attribute value input and display screen. If the attribute value about the basic structure of expressing the configuration pattern of the model for a design is inputted The configuration data of the knot scale beforehand registered for every configuration pattern Search as a key, and when the function which displays this input attribute value, and a user click the attribute name column of an attribute value input and a display screen, each attribute item in the above-mentioned attribute model The knot scale Fig. display function for an attribute value input to which a user can check easily the contents of the attribute which is going to judge, is going to have the function which displays the dimension line for a configuration and a color in distinction from a knot scale Fig. top, and is going to input to which dimension of the

configuration of the model for a design it corresponds is prepared.

[0062] By moreover, the function in which the design exchange method by this invention displays the aforementioned attribute value input and display screen, the knot scale drawing side for an attribute value input or the design proposal display screen, and inference activation and a procedure guide command menu on coincidence While being able to compare the contents of the attribute value which the user inputted, and the design proposal generated based on the inputted attribute value and being able to perform evaluation to a user's design proposal easily When there is a problem, a procedure guide function can be chosen immediately and it enables it to operate a cure easily.

[0063] Moreover, the design exchange method by this invention so that the model change function for a design may become with a required attribute set and a constraint set according to product structure in generation of the design proposal to input attribute value or modification of the attribute value in the middle of a design, and generating of conflict After changing automatically the attribute and constraint knowledge of the model for a design which are used for generation of a design proposal, the list after the change of the attribute name column and the attribute value column is displayed. Also when product structure changes, a user enables it to input attribute value which was able to take adjustment by providing the function which displays the selectable value after the change of this attribute value as an alphabetic character or a drawing menu, if one more attribute value column is chosen as a user.

[0064] Moreover, when a user wants, as for the design exchange method by this invention, to create a design proposal to new housings at the time of starting of this design exchange method, A user enables it to choose for the employment purpose by providing the function which displays new / registered housing data selection screen which can choose employment of a system according to the case where he wants to correct the design proposal of the already created housing in the input guidance means of the engineering-data-management section.

[0065] Moreover, it enables it for the interactive-mode design exchange method by this invention to build the model for a design easily by providing further the design modern-construction section which consists of the function which displays the attribute modern construction and the correction screen which registers an attribute subject name and an attribute item value, and is corrected, and the function which displays constraint knowledge registration / correction screen which registers [constraint and] the knowledge of procedure know-how and is corrected.

[0066] Moreover, a constraint extract means which can be started extract the constraint which can be started to the inputted attribute value, and the starting constraint judging means which performs in a conflict resolution in case there is two or more constraint which can be started provide using constraint, and the weight data and the direction data which can be constraint spread showing the significance of an attribute, and the design exchange method by this invention makes a suitable design procedure generable to a demand.

[0067] Moreover, the design exchange method by this invention makes a suitable design procedure possible to a demand by providing the design-strategy knowledge which stores each constraint and the weight data of an attribute for two or more demand patterns of every, in order to use a design procedure properly according to the demand pattern of the customer who is the pattern with which the relation of the attribute value which a customer demands, and the attribute value which should be outputted as an inference result of it completely differs.

[0068] Moreover, by providing a model change means to change the constraint and the attribute set used for constraint propagation, based on the service condition of constraint in the product structure knowledge of defining the attribute set which can be taken for every product structure, and constraint knowledge, the design exchange method by this invention changes constraint and an attribute set dynamically, and makes inference possible.

[0069] Moreover, when conflict generates the design exchange method by this invention in the middle of inference, If inference is interrupted at the time, it warns of the situation of conflict and a user chooses cure planning, it is based on cure know-how. If the constraint which a user eases according to the cure know-how advice means and advice which advise on the conflict dissolution approach about modification of product structure, and relaxation of constraint and modification of the inputted attribute value is chosen By providing a constraint relaxation means to change constraint level, correspondence also of the time of conflict generating is enabled quickly.

[0070] Moreover, the design exchange method by this invention can describe constraint in the form of a table, equality, and inequality, and the user for whom the knowledge for describing language was insufficient also enables registration of knowledge.

[0071] Moreover, if the attribute value about the basic structure of expressing the configuration pattern of

the model for a design is inputted, the design exchange method by this invention A knot scale graphic form retrieval means to search this input attribute value for the knot scale graphic data beforehand registered for every configuration pattern as a key, When the searched knot scale graphic form is displayed and a user clicks the attribute name column of an attribute value input and a display screen, each attribute item in the above-mentioned attribute model A user enables it to check easily the contents of the attribute which it is going to input to which dimension of the configuration of the model for a design it corresponds, and by judging and establishing a knot scale graphic-display means to display the dimension line for a configuration and a color in distinction from a knot scale Fig. top. Moreover, it enables it to build knot scale graphic data easily by establishing a knot scale graphic-data registration means to register knot scale graphic data, graphic data, correspondence of an attribute subject name, and the retrieval conditions of a knot scale graphic form.

[0072] Moreover, the design exchange method by this invention prepares the constraint relaxation level storage section holding the constraint and relaxation level which were eased in order to draw a result in the middle of a design solution or a design. Moreover, the design intention storing section which memorizes [which came to ease the constraint] a design intention is prepared.

[0073] Moreover, the design exchange method by this invention enables a user to choose the thing nearest to hope as a design solution from candidate solutions by providing a candidate solution generation means to output the candidate of all the design solutions that can be taken, to a demand.

[0074]

[Function]

As for the design exchange equipment which has the <functional> above-mentioned design exchange method, processing is performed by the workstation etc. If the selection menu of a design pattern is displayed on a display by the design strategy-management means of the engineering-data-management section and the operating engineer who is a user chooses a design pattern first, a design strategy-management means will assign each attribute item and the weight data of constraint which have been registered for every design pattern to the attribute and constraint in the model storage means for a design. Next, the inputted attribute value is set as the attribute item to which the attribute model in the model storage means for a design corresponds with the attribute value input guide means of the engineering-data-management section if a user inputs the attribute value which displays the menu about each attribute value for a design on a display, and a customer demands. After an input is completed, the engineering-data-management section makes automatic selection of the type of the model for a design used for generation of a design proposal corresponding to the inputted requirement specification. Next, it opts for a procedure for a design-procedure flare part to calculate a design solution with reference to the design situation which are the setting situation of attribute value, "a new setup of a value", "correction of a value" or "conflict generating", etc. for example, when a design situation is "a new setup of a value" The inside of the constraint knowledge which the constraint propagation execution sequence decision means of a design-procedure flare part is started, and is held at the model storage means for a design in the engineering-data-management section, With reference to the existence of a lock and unlocking assignment to attribute value [finishing / a setup] and attribute value, extract the constraint which can be started, and when two or more extracts are carried out Determine one constraint which carries out new constraint propagation activation, and when a design situation is "correction of a value" Extract the constraint which can be further started by the existence of a lock and unlocking assignment to attribute value in relation to the attribute item which corrected the value, and when two or more extracts are carried out One constraint which carries out correction propagation activation is determined, and the attribute value relevant to a constraint name is transmitted to the design actuation activation section as data of a design procedure at the design actuation activation section. Here, when two or more extracts of the constraint which can be started are carried out, weight of the constraint which competes is compared and the constraint whose significance is size most is determined as a candidate for starting. Furthermore, when two or more constraint whose significance is size most exists, weight of the attribute item relevant to the constraint which competes is compared, and the constraint which can set up a more important attribute item is determined as a candidate for starting.

[0075] When a design situation is "conflict generating", a procedure guide means is started and the attribute value modification approach for a conflict dissolution is generated. When there is no approach of a conflict dissolution, automatic or a user judges by the interactive mode, performs constraint relaxation, and generates a substitute design proposal.

[0076] Based on the constraint directed from the design-procedure flare part, the design actuation activation section calculates a design solution, and stores a value in the engineering-data-management

section. In the design actuation activation section, with a partial constraint propagation means, the value of an undecided attribute item is calculated by giving attribute value [finishing / a setup] to the attribute item of the parameter of constraint expressed with equality, and a result is stored in the attribute model in the model for a design of the engineering-data-management section. Or with a candidate solution generation means, attribute value [finishing / a setup] is given to the attribute item of the parameter of constraint expressed on the table, the value of an undecided attribute item is searched, and the combination of attribute value is searched for. Consequently, when there is two or more combination, on a constraint network, or it narrows down the combination of a candidate's attribute value from those interrelations, display the combination of attribute value on a display serially, and a user is made to choose by the interactive mode in consideration of two or more constraint, and a candidate is narrowed down. The combination of the selected attribute value is stored in the attribute model in the model for a design of the engineering-data-management section. Or it confirms whether there is any combination of the attribute value same whether with a conflict detection means, attribute value [finishing / a setup] is given to all the attribute items of the parameter of constraint expressed with equality, a table, or inequality, and equality and inequality are realized and in a table, and a result is stored in the attribute model in the model for a design of the engineering-data-management section. When the result of a conflict check is O.K., i.e., "nothing [conflict]", a design-procedure flare part will be performed if there is constraint in which constraint propagation activation is otherwise possible with attribute value including the newly set-up value. When the result of a conflict check is NG, i.e., "conflict generating", conflict dissolution or constraint relaxation is performed with the above-mentioned procedure guide means. If a user chooses from the contents of a conflict dissolution or constraint relaxation, based on this, the design actuation activation section corrects attribute value, and stores a value in an attribute model. Since design processing is interrupted when undecided attribute value still remains and there is no generating of conflict, the attribute which can calculate most of other undecided attribute value in inputting a value by the question generation function is asked to a user. A reply of a user sets a value as an attribute model. Constraint propagation is performed based on this. The above-mentioned processing is repeated, when generating of conflict does not have the total attribute value in the model for a design a setting settled, it judges with the design proposal having been generated and the engineering-data-management section displays a design proposal on a display. Moreover, it is in the middle of a design, and if attribute value is changed, the engineering-data-management section will make it possible to change the attribute set and constraint set which are the model for a design used for generation of a design proposal, to follow a dynamic change of product structure, and to continue a design.

[0077] Thus, if attribute value [finishing / a setup / already] is corrected or it inputs a demand of a customer as a value of an attribute item by preparing the engineering-data-management section, a design-procedure flare part, and a design activation control unit, based on the modification propriety of the constraint knowledge between attribute items, or each attribute value, it can opt for a design procedure and the design proposal which fills a demand can be obtained by the interactive mode. Moreover, since the execution sequence and direction of constraint are controlled using constraint significance or the significance of an attribute item, the design procedure according to various demand patterns can be generated automatically by using the significance data of the attribute and constraint registered for every demand pattern. Moreover, it is in the middle of a design, and if conflict occurs, it is possible to give a user the guidance about a design procedure and to design correctly and quickly by generating the alternative design proposal by the conflict dissolution approach or constraint relaxation. Moreover, it is possible to perform drawing output and arrangements based on this result.

[0078] As for actuation of the design exchange equipment of the interactive mode which has a screen and a <actuation> book design exchange method, processing is performed by the workstation etc. If this interactive mode design exchange method is started, the attribute value input guide means of the engineering-data-management section will display new / registered housing data selection screen on a display first. When the operating engineer who is a user chooses ****, next, an attribute value input guide means displays a control panel screen on a display, and displays an inference mode selection menu, preservation / non-saving selection menu of inference activation trace information, a display / non-display selection menu of an inference activation trace screen, and a display / non-display selection menu of a drawing menu on this screen. Moreover, the design strategy-management means of the engineering-data-management section displays the selection menu of demand pattern No. on a control panel screen. If the operating engineer who is a user chooses a design pattern, a design strategy-management means will assign each attribute item and the weight data of constraint which have been registered for every design pattern to the attribute and constraint in the model storage means for a design. Moreover, if a user

chooses inference mode, design hysteresis information, an inference activation trace screen, and a drawing menu next, each data will be set as a control section. Termination of a setup displays the attribute value input and the display screen for a design on a display with the attribute value input guide means of the engineering-data-management section.

[0079] Or it displays, after setting up the value which read registered housing data from the hysteresis database, and the attribute value input guide means of the engineering-data-management section read to the display on new / registered housing data selection screen in the attribute value input and the display screen for a design when the operating engineer who is a user chose a registered housing.

[0080] Next, if a user clicks the attribute value column corresponding to the demand on an attribute value input and the display screen when a user inputs the attribute value which a customer demands, the list of values with this selectable attribute value will be displayed as an alphabetic character, a range of number, or a drawing menu. If a value is chosen from this inside, the selected attribute value will be set as the attribute item to which the attribute model in the model storage means for a design corresponds. Moreover, about the thing a user wants to forbid modification of the value by inference to among input attribute value, if the lock/unlocking setting column of this attribute is clicked, it will be set as a lock condition. If an attribute sees, the broth item list is displayed as the input approach of attribute value here and a user chooses one of header entries of this, it can also perform displaying the attribute of this header entry on an attribute value input and the display screen. If the attribute value which expresses the configuration pattern for a design first is inputted when inputting the attribute value about the configuration for a design furthermore, it can also perform that correspond to which dimension of a configuration, or it is shown and the attribute corresponding to a demand of a customer guides with the dimension line by displaying the knot scale Fig. registered beforehand.

[0081] After repeating this actuation and completing a demand input, a user clicks an inference activation command menu. Then, the engineering-data-management section makes automatic selection of the type of the model for a design used for generation of a design proposal corresponding to the inputted requirement specification. Next, it opts for a procedure for a design-procedure flare part to calculate a design solution with reference to the design situation which are the setting situation of attribute value, "a new setup of a value", "correction of a value" or "conflict generating", etc. for example, when a design situation is "a new setup of a value" The inside of the constraint knowledge which the constraint propagation execution sequence decision means of a design-procedure flare part is started, and is held at the model storage means for a design in the engineering-data-management section, With reference to the existence of a lock and unlocking assignment to attribute value [finishing / a setup] and attribute value, extract the constraint which can be started, and when two or more extracts are carried out Determine one constraint which carries out new constraint propagation activation, and when a design situation is "correction of a value" Extract the constraint which can be further started by the existence of a lock and unlocking assignment to attribute value in relation to the attribute item which corrected the value, and when two or more extracts are carried out One constraint which carries out correction propagation activation is determined, and the attribute value relevant to a constraint name is transmitted to the design actuation activation section as data of a design procedure at the design actuation activation section. Here, when two or more extracts of the constraint which can be started are carried out, weight of the constraint which competes is compared and the constraint whose significance is size most is determined as a candidate for starting. Furthermore, when two or more constraint whose significance is size most exists, weight of the attribute item relevant to the constraint which competes is compared, and the constraint which can set up a more important attribute item is determined as a candidate for starting.

[0082] Based on the constraint directed from the design-procedure flare part, the design actuation activation section calculates a design solution, and stores a value in the engineering-data-management section. In the design actuation activation section, with a partial constraint propagation means, the value of an undecided attribute item is calculated by giving attribute value [finishing / a setup] to the attribute item of the parameter of constraint expressed with equality, and a result is stored in the attribute model in the model for a design of the engineering-data-management section. On a control panel screen, when the inference activation trace screen is set up with "the display", an inference activation trace screen is displayed and the attribute value set up by inference/operation is indicated by sequential.

[0083] Or with a candidate solution generation means, attribute value [finishing / a setup] is given to the attribute item of the parameter of constraint expressed on the table, the value of an undecided attribute item is searched, and the combination of attribute value is searched for. Consequently, when there is two or more combination, in consideration of two or more constraint on a constraint network, the combination of a candidate's attribute value is narrowed down from those interrelations.

[0084] Moreover, when two or more combination occurs in attribute value during inference and the "sequential selection" is set up in inference mode, display an attribute value selectable combination screen on a display serially, a user is made to choose by the interactive mode, and attribute value is narrowed down from the candidate of combination. The combination of the selected attribute value is stored in the attribute model in the model for a design of the engineering-data-management section. Or when "candidate maintenance" is chosen in inference mode, it holds to the range of each attribute in an attribute model as a candidate value, inference is continued to it, and the color of a candidate value is displayed on it in distinction from the inference termination back in the menu of the attribute value of an attribute value input and the display screen.

[0085] Or it confirms whether there is any combination of the attribute value same whether with a conflict detection means, attribute value [finishing / a setup] is given to all the attribute items of the parameter of constraint expressed with equality, a table, or inequality, and equality and inequality are realized and in a table, and a result is stored in the attribute model in the model for a design of the engineering-data-management section. When the result of a conflict check is O.K., i.e., "nothing [conflict]", a design-procedure flare part will be performed if there is constraint in which constraint propagation activation is otherwise possible with attribute value including the newly set-up value. When the result of a conflict check is NG and a design situation is "conflict generating", the conflict generating message screen which interrupts constraint propagation activation and carries out the message indicator of the contradictory contents of constraint is displayed. Or among constraint, constraint of the gestalt of the inequality showing the design basis "whether attribute value is larger than the permission minimum value" is checked at the last of constraint propagation activation, and a check result is displayed on a design proposal evaluation result screen.

[0086] If a procedure guide command menu is clicked in order that a user may acquire the approach of canceling conflict here, a procedure guide means is started, the attribute value modification approach for a conflict dissolution will be generated, a cure planning screen will be displayed, and a user will choose from the contents of the conflict dissolution. When there is no approach of a conflict dissolution, when a user judges by the interactive mode and performs constraint relaxation, the contents display screen of constraint relaxation is displayed, and it chooses [automatic or] which constraint is eased to which level. By next, if an inference activation command menu is clicked again, the design actuation activation section will correct attribute value, will store a value in an attribute model, will repeat this, and will generate a substitute design proposal.

[0087] Since design processing is interrupted when undecided attribute value still remains and there is no generating of conflict, he is urged to generate the attribute which can calculate most of other undecided attribute value in inputting a value, to display a question generation screen, and for a user to input the value of the attribute by the question generation function. A reply of a user sets a value as an attribute model. Constraint propagation is performed based on this. If a user clicks an examination Fig. display command menu when the above-mentioned processing is repeated and generating of conflict does not have the total attribute value in the model for a design a setting settled, the design proposal indicative-data generation means of the engineering-data-management section will display a design proposal display screen on a display. Moreover, each attribute value distinguishes a color in an attribute value input and a display screen, and is displayed on it by what the user inputted, a default value, and the value set up by inference.

[0088] Moreover, it carries out being in the middle of a design, changing the attribute set and the constraint set which is the model for a design which the engineering-data-management section will use for generation of a design proposal if the attribute value about the structure pattern of a product is change, displaying the attribute-value input and the display screen after a change, following to a dynamic change of product structure, as the attribute-value input and the display which was able to took adjustment to the user can carry out, and continuing a design as it is possible.

[0089] Thus, if attribute value [finishing / a setup / already] is corrected or it inputs a demand of a customer as a value of an attribute item by preparing each display screen which advances processing of the engineering-data-management section, a design-procedure flare part, and a design activation control unit by dialogue actuation with a user, based on the modification propriety of the constraint knowledge between attribute items, or each attribute value, it can opt for a design procedure and the design proposal which fills a demand can be obtained by the interactive mode.

[0090] A <configuration which changed view> book design exchange method operates as follows. The menu of the demand pattern which is the pattern of contents to examine with an attribute input screen with an input guide means first displays, and a model change means determines the attribute set which uses for

inference, extracts the attribute data of this set from the attribute model knowledge base, and develops on an attribute model using product structure knowledge based on the attribute value about the classification of product structure in the attribute value which a user demands, and the attribute value which will demand if a demand pattern chooses. The constraint from which a model change means furthermore becomes good [a service condition] with the attribute value relevant to the developed attribute restrained or inputted is extracted out of the constraint knowledge base, and it develops on constraint knowledge. Next, a design strategy-management means reads the significance of the constraint and the attribute corresponding to the value of a demand pattern from design-strategy knowledge, and significance is set as the attribute and constraint on the attribute model which is developing the attribute and constraint used for inference, and constraint knowledge. Next, the attribute value as which the input guide means was inputted into the developed attribute is set up.

[0091] Next, initiation of inference of a user's selection extracts the constraint which can be started to the attribute value as which the constraint extract means which can be started was inputted. In the case of an extract, the gestalt (formulas, such as a table, inequality) of each constraint and the directivity which can be started are judged. In a starting constraint judging means, it judges more by the significance of the constraint and the attribute which is competing as the constraint to which large constraint of the significance of a related attribute which is large constraint of significance and determines a value should be fulfilled, and the extracted constraint which can be started tells to a partial constraint propagation means, when those with two or more and contention occur. With a partial constraint propagation means, the stereo of the constraint directed with the starting constraint judging means is read, and count of undecided attribute value and count of correction attribute value are performed according to a starting gestalt. Moreover, the constraint which conflict of a conflict detection means during activation of partial constraint propagation generated is detected. When a conflict detection means detects conflict, inference is interrupted and it warns a user of conflict having occurred. When a user chooses cure planning here, a cure know-how advice means advises on the modification approach of the product structure for canceling conflict, the relaxation approach of constraint, and the inputted modification approach of demand attribute value based on cure know-how.

[0092] When a user chooses modification of product structure and changes the attribute value of the product structure corresponding to this, a model change means operates according to a modification value, and while changing into an inactive condition the constraint relevant to the attribute no longer using with a modification value based on the service condition in product structure knowledge and the constraint knowledge base, and this, constraint suitable for a service condition is made into an active state. The attribute and constraint set which changed as a result are developed on the attribute model used for inference, and constraint knowledge. Activation initiation of the constraint propagation is carried out again after this.

[0093] Or when relaxation of constraint of a user is chosen, a constraint relaxation means changes the relaxation level of the constraint which the user chose, and reruns constraint propagation after this.

[0094] Or when a user chooses correction of attribute value, the input attribute relevant to the constraint which conflict of a constraint propagation hysteresis maintenance means generated is extracted, and the value with which a back propagation means should correct this input attribute value is computed. A user chooses this adjusted value and starts constraint propagation again.

[0095] If it can be repeatedly found in the condition that there is no conflict of attribute value until all the attribute value that uses the above processing for inference is determined without conflict, a design solution display means will display attribute value and the configuration for a design of corresponding. If inference is completed with undecided attribute value remained, a question generation means will generate the question to which the input of undecided attribute value is demanded from a user.

[0096] The design exchange method according to this invention as mentioned above can calculate a design solution, canceling [can carry out inference continuation, and] conflict quickly by the interactive mode, since incorporation of know-how is possible, also when the design procedure according to various demands can be generated and it is accompanied by structural change.

[0097] <Knot scale graphic form for an input> As for the design exchange equipment which performs a knot scale graphic display again, processing is performed by the workstation etc. A demand of a user will be inputted if this design exchange equipment is started. If the attribute value of the basic structure of expressing the configuration pattern for a design during this input is inputted, a knot scale graphic form retrieval means will be started by using this attribute value as a key, and the knot scale graphic form corresponding to a key will be searched. Next, if a knot scale graphic form is searched, a knot scale graphic-display means will display a knot scale graphic form. If the attribute item column of a demand

attribute value input means is clicked, the displayed knot scale graphic form will be the dimension line about the dimension of the inside for a design corresponding to this attribute item, and will display a color in distinction from a configuration. Thus, when it corresponds to which dimension of a configuration, or it is shown and the attribute corresponding to a demand of a customer guides with the dimension line by displaying a knot scale Fig., it is possible to perform a design entry of data correctly and quickly.

[0098] <Constraint management method> The design exchange equipment which has a constraint management method again is realized on the computer-aided design which consists of one design exchange equipment by a workstation etc., two or more design exchange equipments or two or more design exchange equipments, and a file server.

[0099] A design intention is memorized [which came to ease a result, the eased constraint, the information about constraint relaxation level, and a constraint in the middle of the design at the time of a designer designing using design exchange equipment] by the attribute value storage section, the constraint relaxation level storage section, and the design intention storage section. At the time of design termination or interruption, the information on the attribute value storage section, the constraint relaxation level storage section, and the design intention storage section is associated mutually, and is stored in the result storing section, the constraint relaxation level storing section, and the design intention storing section a design solution / in the middle of a design.

[0100] In correcting a design solution or continuing a design using a result in the middle of a design solution or a design The constraint and relaxation level which were eased in order to draw a result with the data of a result from each design exchange equipment in the middle of the design solution or a design in the middle of a design solution or a design, Since the data in which a design intention is shown [which came to ease the constraint] are transmitted to each design exchange equipment, without the contents of decision making made at the time of a former design and decision disappearing, a design solution is corrected or it becomes possible to continue a design.

[0101] <Candidate solution generation> Based on the candidate value of the attribute value generated during activation of constraint propagation, the combination between each candidate value is created, the constraint propagation of each combination is carried out, and the combination which conflict generated in the middle is eliminated and expresses the attribute value which this determined as the combination which conflict did not generate as a candidate solution as a candidate solution generation means again.

[0102]

[Example]

Drawing 13 explains the 1st example of this invention from drawing 1 to below the [example 1].

[0103] Drawing 1 is the outline functional block diagram showing one example of the design exchange equipment which has a design exchange method by this invention. In drawing 1, 101 stores the attribute model and constraint knowledge of the model for a design. The input of attribute value, The attribute value input guide function which generates the input menu in the case of inputting the engineering-data-management section which displays a design proposal, and the attribute value as which a customer demands 102, A design proposal display means to display the design proposal that 103 fills a demand, the model for a design, with which 104 consists of an attribute model and constraint knowledge, The constraint knowledge which stores the constraint whose 105 expressed the relation between attributes on equality, inequality, and a table, The attribute model which 106 describes the specification of a product in the group of an attribute subject name and attribute value, and is stored, The model change function in which 121 changes the model for a design according to change of product structure, 107 determines a constraint propagation execution sequence based on attribute value and a design situation. [finishing / a setup] Or the design-procedure flare part which performs the dissolution approach and constraint relaxation at the time of conflict generating, 108 extracts the constraint which a design situation can start in "a new setup of a value", and "correction of a value." When a design situation is "generating of conflict", the constraint propagation sequence decision function to determine the constraint to fulfill, and 109 The procedure guide function which guides a user's procedure by a conflict dissolution or constraint relaxation, The conflict dissolution function in which 110 generates the attribute value modification approach for the dissolution of conflict, Among undecided attributes, if a value is set up, a value the constraint relaxation function which eases constraint knowledge when the approach of a conflict dissolution is not found, while using 111 for generation of a design proposal, and 122 The question generation function to ask what can determine most other attribute value, the design actuation activation section which 112 performs inference/operation of non-set up attribute value based on the attribute relevant to the constraint directed from the design-procedure flare part, and sets a value as the attribute value slot in the attribute definition knowledge base, The partial constraint propagation function in which 113 performs inference/operation of attribute value,

the candidate solution generation function, in which 114 narrows down the range of the candidate value of an attribute, or a value from the interrelation of constraint, The conflict detection function in which 115 checks the existence of conflict between attribute value [finishing / a setup], The setting situation and design situation of attribute value that a design-procedure flare part refers to 116, The activation constraint which determined 117 by the design-procedure flare part, and its related attribute, Storing of the attribute value acquired as a result of reasoning / calculating 118 in the design actuation activation section, or the value of the existence of conflict detection, the workstation which is design exchange equipment with which 119 has the design exchange method of this invention, and 120 are operating engineers who are users.

[0104] Drawing 2 is the example of the hardware configuration for functioning drawing 1 . For a system bus and 202, as for a central processing unit and 204, in drawing 2 , bus control equipment and 203 are [201 / main storage and 205] a keyboard and a printer by which in a display and 207 a disk controller and 209 print a disk and, as for 210, a mouse and 208 print [206] a design solution.

[0105] Drawing 3 is the example of the software configuration for functioning drawing 1 . A data input means to store in a disk or main storage if the attribute of requirement specification is inputted into the control section which 301 makes start each means in drawing 3 , and 302 from a keyboard or a mouse, An output means for 303 to read the output of a design proposal from a disk or main storage, and to display on a display, An attribute value input guide means for 304 to generate an input menu when inputting attribute value, and to display on a display, A design proposal indicative-data generation means to generate the data for a plot for 305 to display a design proposal, A design situation data storage means for 306 to store the value of design situations, such as "a new setup of a value", "modification of a value", and "generating of conflict", in main storage, and to update, A model change means for a design by which 315 changes the model for a design according to change of product structure, A constraint propagation execution sequence decision means by which 307 determines a constraint propagation execution sequence according to attribute value and a design situation, [finishing / a setup] A conflict dissolution means by which 308 generates the modification approach of attribute value for the dissolution at the time of conflict generating, As opposed to a question generation means to generate a question for the constraint relaxation means which eases constraint in order that 309 may generate a substitute design proposal, and 316 to determine undecided attribute value, and the constraint, to which 310 was expressed with equality As opposed to a partial constraint propagation activation means to calculate undecided attribute value by giving attribute value [finishing / a setup] to the parameter of a formula, and the constraint, to which 311 was expressed on the table Give attribute value [finishing / a setup] to the parameter of a table, and undecided attribute value is searched. As opposed to the candidate solution generation means which will display a candidate value serially, and a user will be made to choose, and will narrow down a candidate or it narrows down from the interrelation of constraint of the combination of attribute value if there are two or more results, and the constraint to which 312 was expressed on equality, inequality, and a table A conflict detection means to confirm whether attribute value [finishing / a setup] is given to all the parameters, and there is any combination of the value same whether equality and inequality are filled and in a table, the attribute model knowledge base where 313 registers an attribute model, and 314 are the constraint knowledge bases which register constraint.

[0106] It is possible to list as an attribute the specification item which expresses the structure and the engine performance of a product with the design exchange method by this invention, and it is possible to apply, if it is the product which is arranged by the design manual etc. in the form of a formula or a table in the causal relation and the design basis between specification items, and can define constraint. Moreover, variety is in a demand of a customer, a specification item especially important for whenever [the] is changed, the procedure of a design changes, and when conflict of the attribute value which the contents of reference of a design manual do not be [attribute value] different or understand by the design manual occurs, as canceling by a designer's know-how is a design, the product of a type which is generated frequently is turned to.

[0107] Hereafter, the case of an elevator is explained as an example as one of the above object products. Drawing 13 expresses the whole elevator configuration. An elevator mainly consists of devices, such as a "cage" which puts people and a load, the "arm shaft counterbalance" and the "cage" which were tied with the rope in order to take a "cage" and equilibrium, and a "loop wheel machine" which makes a "arm shaft counterbalance" go up and down, and these are arranged in a "hoistway", "machine room", etc. The "hoistway frontage", "hoistway depth" whose structures of an elevator are the frontage dimension of the "hoistway" in which each device of an elevator is installed in a building, and a depth dimension, So that it may be suitable to the attribute value which the customer "LOAD" which is the possible weight of loading

** "a cage" demands "cage which are the attribute value of each device, i.e., the frontage dimension inside a "cage", the "cage inside distance W" which is a depth dimension, the "cage inside distance D" and the frontage dimension of the outside of a "cage", and a depth dimension — an outer slope — W" and "cage — an outer slope — it is decided by setting up attribute value, such as D." Since the constraint which each attribute value has various variations here, and is expressed on the table of equality, inequality, and combination between the values of two or more attribute items exists, a design proposal can be obtained by deciding the above-mentioned attribute value to fill these constraint. A classification of the attribute model in the case of an elevator and the example of constraint knowledge are shown in drawing 4. The basic specification showing the main functions of elevators [attribute], such as "LOAD" and "SPEED", The basic structure of expressing the arrangement pattern of the device a "balance weight layout type", The building specification showing the building tooth space between elevators, such as a "hoistway" and "machine room", It classifies into the layout specification showing the relative position between devices called the crevice dimension of the device specification, the arrangement coordinate of each device, the sense, the "dead weight", and wall showing attributes, such as a format of each device which constitutes elevators, such as a "cage" and a "loop wheel machine", width of face, and depth.

[0108] Moreover, the table showing the combination of the value with which constraint should be filled between the attribute items of "LOAD", the "cage inside distance W", and the "cage inside distance D" and "cage ****" which is the center position of a cage, It is expressed with a formula, such as expressing the relation between the "entrance heart" which is the center position of an entrance, and the "amount of heart gaps" which is the distance between two, and the inequality showing the relation between a "arm shaft counterbalance", and "the dead weight-posterior-wall-of-stomach distance d" and the "dead weight-posterior-wall-of-stomach distance lower limit" which are a crevice between "hoistways." The correspondence relation of the geometry of an attribute item and an elevator used for drawing 5 in this example is shown. The contents of the data of the attribute model used for drawing 6 in this example are shown. It consists of an established state of lock/unlocking assignment existence of the code of an attribute, a name, range, attribute value, and attribute value, and attribute value. The contents of the constraint knowledge used for drawing 7 in this example are shown. For example, constraint C1 shows the combination of the value which was able to take the adjustment between the "cage inside distance W" which is "LOAD" and the size of a "cage", and the "cage inside distance D." Constraint C4 is constraint of the table for asking for the lower limit of crevice distance, such as the "cage-right wall distance lower limit", from an "extraordinary stop specification" and "SPEED", and is the constraint which should be filled in order to fluctuate safely, without a "cage" and a "dead weight" colliding with a "hoistway." It is constraint of the equality which should be filled respectively in between. constraint C5 and constraint C6 — the thickness of a "cage" side plate sake — "the cage inside distance W" and "cage — an outer slope — W" — between, the "cage inside distance D", and "cage — an outer slope — D" — constraint C12 The x-coordinate of "cage ****" which is the location where the rope for hanging is attached to a "cage" "a cage **** location frontage dimension", It is constraint showing the physical relationship of the "entrance heart" which is the coordinate of the center position of an "entrance". Constraint C13 Constraint of a formula, such as computing the distance between a "cage" and a "hoistway" right wall, and constraint C17 the "amount L of heart gaps" which is the distance between a "cage **** location frontage dimension" and the "entrance heart" — "cage — an outer slope — they are constraint of a formula, such as computing from W" and the "entrance width of face OP", and constraint of whether constraint CC 1 satisfies the lower limit of "cage-right wall distance", and the inequality to check. If the value of the attribute item which a customer demands is inputted, undecided attribute value will be computed by discovering what can be started among constraint of the above, and it will be set as an attribute item. The constraint which can otherwise be started is discovered based on the newly set-up value. By repeating this processing, when all attribute value is able to be decided to satisfy constraint, a design proposal can generate it.

[0109] The contents of the constraint starting condition managed table for judging the constraint which can be started to drawing 8 are shown. It consists of a gestalt which is the expression of constraint, such as the code of each constraint, each equality, inequality, a related attribute that is an attribute item used as the parameter of a table, equality, inequality, and a table.

[0110] Requirement specification is inputted by the attribute value input guide function 102 of the engineering-data-management section 101, and suppose at "LOAD" that "850" is specified as "3010" and "entrance width of face", and "2300" is specified as the "entrance heart" at "150" and a "hoistway frontage dimension" at "850 (kg)" and "SPEED." Namely, if a control section 301 starts the attribute value input guide means 304, the input menu of attribute value is displayed on a display 206 and the operating

engineer 120 who is a user chooses a value with a keyboard 205 or a mouse 207. A central processing unit 203 out of the attribute model knowledge base 313 of the model for a design stored in the disk 209. When a "dead weight layout type" is "back **", the set of an attribute item is called with a disk controller 208, a system bus 201 top is made to transmit with bus control equipment 202, and these data are stored in main storage 204. Similarly, out of the constraint knowledge base 314 of the model for a design stored in the disk 209, a central processing unit 203 calls the set of constraint knowledge with a disk controller 208, when a "dead weight layout type" is "back **", makes a system bus 201 top transmit with bus control equipment 202, and stores these data in main storage 204. Next, a control section 301 starts the data input means 302, and sets up the inputted attribute value into the attribute model 106 in main storage 204. The value of an undecided attribute item is determined based on this input attribute value.

[0111] The constraint network by the attribute of drawing 6 and the constraint of drawing 7 which are used for drawing 9 by this example is shown. Although much more attributes and constraint are needed in order to design the specification of an elevator, a partial constraint network is started for explanation and the structure of the design exchange method by this invention is described on this. drawing 9 — setting — a hoistway flat-surface top — " — if a basic specification and a building specification are inputted, the device specification of an elevator is searched for, a device will be arranged in a "hoistway", a layout specification will be searched for, and it will be confirmed whether the crevice distance of a device and a wall is filling the lower limit — " — ** — the example to say is solved by this design exchange method. The value of a "dead weight layout type" and a an "extraordinary stop specification" is set to drawing 9 in addition to the attribute value which the above-mentioned inputted. As for a "dead weight layout type" value, it is [this] common to examine first the case of "back **" which is the case where a "dead weight" is arranged to the backside [a "cage"] seen from an "entrance." Then, "back **" is set up as a default. The value of an "extraordinary stop specification" sets up " **" similarly. If there is especially no assignment in order that constraint propagation may not progress, if there is little attribute value inputted, for a customer, these values will be parts uninfluential [almost] and will set up important attribute value beforehand on an order-received specification design like basic structure. Moreover, in order to call the above-mentioned attribute model, the default setting value is used. Hereafter, each function of this design exchange method is explained.

[0112] If an input value is set as the attribute item in the attribute model 106, with reference to the setting situation and the design situation 116 of a value, the constraint propagation execution sequence decision function 108 will determine the setting sequence of the attribute value on a constraint network by the design-procedure flare part 107. That is, a control section 301 extracts the constraint which can start the constraint propagation execution sequence decision means 307, and can be started from attribute value [finishing / a setup], and chooses one from the constraint which can be started. Next, if the design actuation activation section 112 is passed by making this activation constraint into a design procedure 117, according to the gestalt of constraint, the partial constraint propagation function 113, the candidate solution generation function 114, or the conflict check function 115 will start, and other attribute value will be calculated based on constraint. Moreover, constraint propagation can be performed in both directions. If calculated attribute value is stored in the attribute model 106 (storing 118 of a value), the flow of one processing will finish.

[0113] For example, starting of constraint C1 and constraint C4 of the constraint which can be started is attained from the constraint starting condition managed table of drawing 8 to the above-mentioned input attribute value. This is because the combination of other related attribute value can be searched out of a table by using this input attribute value as a key if one from 0 to N individual of attribute value is inputted when there is the N number of related attributes since the gestalt of constraint is a table. Next, constraint C1 or constraint C4 is chosen. It shall suppose that it is alike, therefore the selection approach is explained in the 2nd example, and it shall be performed here from the early thing of the description order in a constraint starting condition managed table. Therefore, constraint C1 is determined as activation constraint, and it sends to the design actuation activation section 112 as a design procedure 117. In the design actuation activation section 112, since constraint C1 is a table, "LOAD" uses "850" as a key, the table of C1 is searched, and 2 sets of values of "the cage inside distance W" and the "cage inside distance D" are respectively calculated with "1550", "1300" or "1750", and "1200." This result is expressed like drawing 11 and makes a user choose this combination by the interactive mode in a constraint network. For example, if "the cage inside distance W" chooses with "1550" and "the cage inside distance D" chooses with "1300", attribute value will be decided and "finishing [a setup]" will be set as the attribute model 106 of the engineering-data-management section 101 by the value itself and the established state. Or when it accumulates as an in-house data without the candidate solution generation function's 114 working

namely, choosing a candidate value, and other constraint is fulfilled and the candidate value of attribute value arises further, call the candidate solution generation means 311, and narrow down the combination of attribute value with which these candidate values are filled to coincidence, a user is made to choose the generated candidate solution, and a control section 301 can also determine much attribute value at once. [0114] This is the flow of one processing. When the engineering-data-management section, and a design-procedure flare part and the design actuation activation section interlock as mentioned above, constraint which can be started according to requirement specification can be fulfilled, and the attribute value for a design can be determined.

[0115] Next, the design-procedure flare part 107 checks that conflict has not occurred, extracts the constraint which can be started, and determines activation constraint as the established state of the updated attribute value. Thus, next constraint C4 starts and the candidate solution generation function 114 commits it. Therefore, the "cage-right wall distance lower limit" is called for with "220" from "SPEED" and an "extraordinary stop specification." Next, constraint C5 starts and the partial constraint propagation function 113 works. That is, a control section 301 calls the partial constraint propagation activation means 310. It is because a gestalt is equality and, as for this, the value of N-1 piece was set up for the related attribute to N individual. therefore, the "cage inside distance W" — "cage — an outer slope — W" is set to "1600." the same — constraint C6 — starting — "the cage inside distance D" — "cage — an outer slope — D" is set to "1500" (drawing 11). Furthermore constraint C17 starts and the partial constraint propagation function 113 works. Therefore, "the amount L of heart gaps" is set to "325." Furthermore constraint C12 starts, the partial constraint propagation function 113 works, and the "cage **** location frontage dimension" which is arrangement of a "cage" is set to "1975." Furthermore constraint C13 starts, the partial constraint propagation execution function 113 works, and "cage-right wall distance" is set to "235." The gestalt of the left-behind constraint CC 1 is inequality, and "cage-right wall distance" confirms whether fill the "cage-right wall distance lower limit." This is based on the conflict detection function 115 of the design actuation activation section 112, and the N related attributes of inequality or equality confirm whether fill the equality and inequality, when finishing [a setup of a value] all. In this case, "cage-right wall distance" is "235", since the "cage-right wall distance lower limit" is "220", it fills constraint CC 1, and the result of a conflict check serves as O.K. Although the partial example explained, the value of layout specifications, such as an arrangement location in device specifications, such as size of a "cage", and the "hoistway" of a "cage", can be determined similarly, and it can be confirmed whether conflict arises by these specifications. The design-procedure flare part 107 determines the constraint which can be started one after another by the constraint propagation sequence execution function 108 as mentioned above with reference to the attribute model of the engineering-data-management section 101, and constraint knowledge, the constraint is fulfilled by the design actuation activation section 112, and a design proposal is generated by determining attribute value.

[0116] This order-received specification design exchange approach has the following various functions other than determining the value based on constraint propagation and generating a design proposal newly, when attribute value is undecided as mentioned above. To the design proposal generated once first, a customer changes a certain attribute value and there is a case where he wants to correct the design proposal corresponding to this modification. For example, he wants to correct the "entrance heart", i.e., suppose that the demand of wanting to shift the location of the bus stop of an elevator right and left in a building came out. Since it corresponds to this modification, which attribute value should be changed based on a constraint network, or the constraint propagation execution sequence decision function 108 of the design-procedure flare part 107 searches. That is, if a user changes attribute value using a keyboard or a mouse, a control section 301 will store the data input means 303 in a call, and will store the changed attribute value in the attribute item of the attribute model 106, and an established state will be updated to "finishing [modification]." Next, a control section 301 calls the constraint propagation execution sequence decision means 310, and extracts the constraint relevant to the corrected attribute value with reference to the constraint starting condition managed table of drawing 8 . The related attributes of C12 are the "P19 entrance heart", a "P12 cage **** location frontage dimension", and the "amount of P35 heart gaps", if "P19" is corrected and they will not correct at least one of "P21" or "the P35", they stop filling equality and conflict will generate them. If the "P19 entrance heart" is corrected by constraint C12 so that it may understand in the constraint network of drawing 15 , it is necessary to carry out the correction propagation of at least one attribute value of "the amount L of P35 heart gaps", and a "P21 cage **** location frontage dimension." There are various approaches among the decision approaches of correction propagation sequence. For example, an attribute and the significance of constraint are defined, and although it is also possible to correct an attribute with a small significance in the related attribute of large

constraint of significance, it corrects to order with early description of the related attribute in constraint here. Therefore, a "P21 cage **** location frontage dimension" will be amended, and it will be determined that the size of a "cage" remains as it is and a design procedure will correspond by shifting a location. Constraint 12 and a modification attribute "P21" are sent to the design actuation activation section 112. Then, by the partial constraint propagation execution function 310, the adjusted value of "P21 cage **** location frontage dimension" is computed, a value is stored in the attribute model 106 of the engineering-data-management section 101, and an established state is updated to a "signed off." The constraint relevant to the attribute value which made interlocking correction like the following is extracted, a correction attribute is determined, and processing in which an adjusted value is calculated is repeated. Moreover, since it is the attribute value which a user does not want to change when lock/unlocking assignment is [the correction attribute item] a lock, it is made not to correct this. After correction propagation is completed without conflict occurring as mentioned above, a design proposal is able to be created and a result is displayed by the design proposal display function 103. When the engineering-data-management section, and a design-procedure flare part and the design actuation activation section interlock as mentioned above, correction propagation of the attribute value of the constraint related according to the change request of attribute value can be performed, and the attribute value for a design can be determined.

[0117] Next, the procedure guide function 109 of the design-procedure flare part which are other functions of this design exchange method is explained.

[0118] When conflict occurs in the middle of constraint propagation (correction propagation is included), the design-procedure flare part 107 starts the procedure guide function 109. That is, a control section 301 calls the conflict dissolution means 308 first, and searches for the cause of conflict. For the dissolution approach of conflict, various **** expresses a skillful designer's know-how here in the cure Ruhr, and presupposes at it that this is used. although conflict occurs when "cage-right wall distance" becomes smaller than the "cage-right wall distance lower limit" since the "entrance heart" was shifted to the right — as the know-how of a conflict dissolution — "IF [— constraint CC 1 — "the cage-right wall distance lower limit" — conflict:(cage-right wall distance) >(cage-right wall distance lower limit)] THEN [Move a cure proposal 1:cage **** location frontage dimension to the left.]

[Change cure proposal 2:cage size]. "

If there is the said Ruhr, the procedure guide of a conflict dissolution can be performed to a user.

[0119] In the conflict dissolution function 110, when a design proposal cannot be generated, the design-procedure flare part 107 starts the constraint relaxation function 111 in the procedure guide function 109. This loosens gradually the stereo of the constraint currently used for constraint propagation according to relaxation level, and asks for a substitute design proposal based on this constraint. Although there are various criteria also in the decision of relaxation level, there is a method of including from the combination of the attribute value of standard size to the combination of the attribute value of non-standard size, for example.

[0120] Moreover, as other procedure guide functions, from the inputted attribute value, if the constraint which can carry out constraint propagation is not found and it does not input further, a design may not progress first. In that case, if which attribute value is inputted next, based on a constraint network, it computes whether most undecided attribute value can be determined, and there is a question generation function to ask a user the attribute value.

[0121] Even when conflict occurs in the middle of a specification design as mentioned above, the procedure of a suitable design can be guided by having a design-procedure flare part.

[0122] Moreover, in this design exchange method, the set of the range of a required attribute item and a value is started according to the value of the attribute item showing the name of two or more structure patterns of the model for a design. Make automatic selection of the structure pattern of the model for a design used for generation of the design proposal to the inputted attribute value, or it corresponds to modification of the attribute value in the middle of a design, and generating of conflict. By providing the model change function for a design which changes automatically the structure pattern for [which is used for generation of a design proposal] a design, it is possible to respond to modification in the middle of requirement specification or a design.

[0123] Moreover, it is possible to make construction of the model for a design easy by setting to this design exchange method and providing further the design modern-construction section which consists of the attribute modern construction and the modify feature which registers and corrects an attribute item and an attribute item value, and the constraint knowledge registration and the modify feature which register [constraint and] the knowledge of procedure know-how and are corrected.

[0124] Furthermore, it is applicable to the design exchange equipment which performs drawing output and arrangements based on the design solution acquired by this design exchange method.

[0125] [Example 2] Drawing 23 explains the 2nd example of this invention from drawing 1, drawing 2, and drawing 14 below. This example states the example which enables automatic generation of a design procedure according to various demand patterns by setting up the significance of constraint and an attribute according to the demand pattern, performing priority foreword attachment of the constraint which should be started, and controlling the behavior of constraint propagation.

[0126] Drawing 14 is the example of the software configuration for carrying out this example. Although it is not different from the software configuration fundamentally shown in drawing 3, it has the composition of establishing the design strategy-management means 315 which reads weight data according to the demand pattern which newly registers two or more weight data showing each attribute item and the significance for every constraint into engineering-data-management circles, and was specified, and is assigned to an attribute and constraint.

[0127] It is possible to list as an attribute the specification item which expresses the structure and the engine performance of a product with the design exchange method by this invention, and it is possible to apply, if it is the product which is arranged by the design manual etc. in the form of a formula or a table in the causal relation and the design basis between specification items, and can define constraint. Moreover, variety is in a customer's demand pattern, a specification item especially important for whenever [the] is changed, the procedure of a design changes, and when conflict of the attribute value which the contents of reference of a design manual do not be [attribute value] different or understand by the design manual occurs, as canceling by a designer's know-how is a design, the product of a type which is generated frequently is turned to.

[0128] Hereafter, the case of an elevator is explained as an example as one of the above object products. Drawing 15 shows an elevator customer's example of a demand pattern. The attribute item as which the 1st demand pattern expresses the main functions of elevators, such as "the basic specification of an elevator, for example, "LOAD", and SPEED", beforehand on a customer side, And the building specification showing the building tooth space between elevators, such as a "hoistway" and "machine room", is known. It is the case where he wants to search for the standard device specification and layout specification suitable for a hoistway based on such attribute value, and only the basic specification of an elevator is known, and the 2nd demand pattern corresponds, respectively to know the minimum hoistway size which can arrange the device which fulfills a basic specification. thus, the relation between an input attribute and an important point output attribute — the difference in a demand pattern — ***** — things are understood. This example explains the automatic generation process of a design procedure corresponding to each about the above-mentioned demand patterns 1 and 2.

[0129] In advance of a system startup, the data currently held in the attribute model knowledge base 313 and the constraint knowledge base 314 are explained first. The DS of the attribute model used for drawing 16 in this example is shown. It consists of area holding the established state of the lock / proposal lock assignment existence of the code of an attribute, a name, range, a value, and attribute value, and attribute value, and the weight data of an attribute. In the initial state, the data corresponding to the attribute item extracted in order to express the design specification of a product beforehand are registered into each area of a code, a name, and range, and ** non-"set" up is set to "unlocking" and the established-state maintenance area of attribute value in lock/unlocking assignment existence area of attribute value. Moreover, nothing is set to the area holding attribute value and the weight data of an attribute.

[0130] The contents of the constraint knowledge used for drawing 17 in this example are shown. For example, constraint C1 shows the combination of the value which was able to take the adjustment between the "cage width of face" which is "LOAD" and the size of a "cage", and "cage depth." It is a formula that constraint C2 shows relation with "crevice d" which is a "hoistway frontage dimension", and "cage width of face" and the crevice dimension of a cage and a wall etc., and "crevice d of equality for constraint C3 to ask for "crevice d" which is the minimum crevice dimension of a cage and a wall from the "crevice d lower limit", and constraint C4" is the inequality whether the lower limit is satisfied and for checking. Constraint C5 is constraint of the table for asking for the "crevice d lower limit" from "SPEED", and is the constraint which should be filled in order to fluctuate safely, without a "cage" and a "dead weight" colliding with a "hoistway." These constraint is held at the constraint starting condition managed table in the constraint knowledge base 314.

[0131] The contents of the constraint starting condition managed table are shown in drawing 18. It consists of a gestalt of constraint, such as a code of each constraint, a related attribute name of each constraint, equality and inequality, and a table, and area as for which each constraint carries out weight

data-hold. In the initial state, as only the area constraint carries out [area] weight data-hold shows other area in drawing by un-setting up, the information on C5 is beforehand registered from constraint C1. Moreover, the stereo of constraint is beforehand registered into the disk 209 by making the code of constraint into a header, as shown in drawing 19 .

[0132] Moreover, the design strategy-management table as shown in drawing 20 is registered into the disk 209. Although the significance data of the constraint and the attribute for every demand pattern code and demand pattern code are held, it is given as or more 0.0 1.0 or less value, and the value of significance data has so large that it is close to 1.0 a significance.

[0133] The procedure in the case of performing hereafter two kinds of designs of the demand patterns 1 and 2 which the user mentioned above is explained.

[0134] If a system is started, from the attribute model knowledge base 313 of the model for a design registered into the disk 209, transmit a call with a disk controller 208, and a control section 301 makes a system bus 201 top transmit with bus control equipment 202, and stores in main storage 204 attribute item data (drawing 22) and the constraint data (drawing 18 , drawing 19) held at the constraint starting condition managed table in the constraint knowledge base 314. Next, a control section 301 starts the design strategy-management means 315. The design strategy-management means 315 reads all the demand pattern codes of the design strategy-management table (drawing 20) registered into the disk 209, and displays them on a display 206. A user chooses what agreed for the purpose among the displayed demand pattern codes using a keyboard 205 or a mouse 207. The case where the demand pattern 1 is chosen first is explained.

[0135] The design strategy-management means 315 reads the weight data of the constraint and the attribute corresponding to the selected demand pattern 1 from the design strategy-management table registered into the disk 209, and stores them in the weight data-hold area of the constraint starting condition managed table on main storage 204, and the weight data-hold area of an attribute model. constraint C1 — 0.8 and constraint C2 and C5 — 0.6 and constraint C3 — 0.3 and constraint C4 — 0.4 — moreover, the weight data of 0.4 will be assigned to 0.9 and attributes p3 and p4 to 0.8 and p6 0.3 and p7 at attributes p1, p2, and p5, respectively.

[0136] Next, a control section 301 starts the attribute value input guide means 304, the input menu of attribute value is displayed on a display 206, and a user inputs attribute value using a keyboard 205 or a mouse 207. Suppose that the inputted attributes were "LOAD=800", "SPEED=120", and "hoistway frontage dimension =3000." While the attribute value input guide means 304 sets up such attribute value into the attribute model 106 in main storage 204, "finishing [a setup]" is set as the setting situation area of a value. Based on this input attribute value, by repeating the following processings, the value of an undecided attribute item is determined and it goes.

[0137] If an input value is set as the attribute item in the attribute model 106, with reference to the setting situation and the design situation 116 of a value, the constraint propagation execution sequence decision function 108 will determine the setting sequence of the attribute value on a constraint network by the design-procedure flare part 107. That is, a control section 301 extracts the constraint which can start the constraint propagation execution sequence decision means 307, and can be started from attribute value [finishing / a setup], and chooses one from the constraint which can be started. Next, if the design actuation activation section 112 is passed by making this activation constraint into a design procedure 117, according to the gestalt of constraint, the partial constraint propagation means 310, the candidate solution generation means 311, or the conflict check means 312 will start, and other attribute value will be calculated based on constraint. Moreover, constraint propagation can be performed in both directions. If calculated attribute value is stored in the attribute model 106 (storing 118 of a value), the flow of one processing will finish.

[0138] A motion of the constraint propagation execution sequence decision means 307 in a series of upper processings is explained using the constraint propagation sequence decision flow shown in the constraint network shown in drawing 21 , and drawing 22 . In addition, each attribute of drawing 21 and the figure on constraint express weight data.

[0139] The constraint propagation execution sequence decision means 307 extracts first constraint which can be started to input attribute value like drawing 21 (drawing 22 801). According to the criteria of whether to be able to start constraint, the constraint which agrees in criteria with reference to the value established state of each attribute item of the attribute model of drawing 16 , lock/unlocking established state and the related attribute name of each constraint of the constraint managed table of drawing 18 , and a gestalt is extracted. Consequently, since constraint C1 and constraint C5 are found out, the constraint propagation execution sequence decision means 307 stores constraint C1 and constraint C5 on main

storage 204 as a constraint list which can be started (drawing 22 802). Next, the constraint propagation execution sequence decision means 307 compares weight data about each constraint on [which can be started] a constraint list, and takes them out as constraint which should fulfill large constraint of weight most (drawing 22 803-1). Since the weight of 0.8 and constraint C5 of the weight of constraint C1 is 0.6, constraint C1 is taken out as activation constraint in this case. Next, the constraint propagation execution sequence decision means 307 judges an output attribute name about the taken-out constraint C1 from the related attribute name of the constraint from the constraint managed table of drawing 24 , and a gestalt, and starts the table mold constraint C1 to the partial constraint propagation means 310 of the design actuation activation section, and the instruction "determine an attribute "cage depth" and "cage width of face"" is published (drawing 22 804).

[0140] In response to this, from the constraint stereo on main storage 204 (drawing 19), the partial constraint propagation means 310 reads constraint C1, computes "cage depth =1150" and "cage width-of-face =1650" from an input attribute "LOAD=800" (retrieval), and sets a value as the attribute model of drawing 16 .

[0141] This is the flow of one processing. Constraint will be started by the same processing in order of constraint C5, constraint C2, and constraint C4, each attribute value of "crevice d lower limit =220" and "a crevice d= 675" is determined, and, finally the lower limit check of "crevice d" is checked by constraint C4 2nd henceforth. (However, although constraint C5 and constraint C2 are extracted as constraint which can be started in the case of the 2nd constraint propagation execution sequence decision) since weight is the same as that of 0.6, at an activation constraint judging step, weight of the output attribute item of constraint C5 and constraint C2 is compared further, and activation constraint is extracted. (drawing 22 803-2) As mentioned above by determining the sequence of constraint propagation based on the weight of constraint and an attribute It turns out that the design procedure corresponding to a demand "I want to search for the standard device specification and layout specification which suited the hoistway from basic specifications, such as LOAD and SPEED, and a building specification" of the operating person in charge who is a customer or a user is generated automatically.

[0142] The case where the demand pattern 2 is chosen next is explained.

[0143] The design strategy-management means 315 reads the weight data of the constraint and the attribute corresponding to the selected demand pattern 2 from the design strategy-management table registered into the disk 209, and stores them in the weight data-hold area of the constraint starting condition managed table on main storage 204, and the weight data-hold area of an attribute model. constraint C1 — 0.8 and constraint C2 — 0.6 C5 — 0.9 and constraint C3 — 0.9 and constraint C4 — 0.3 — moreover, 0.9 will be assigned to attributes p3 and p4, and the weight data of 0.34 will be assigned to 0.8 and p5 at attributes p1, p2, p6, and p7, respectively.

[0144] Next, a control section 301 starts the attribute value input guide means 304, the input menu of attribute value is displayed on a display 206, and a user inputs attribute value using a keyboard 205 or a mouse 207. Suppose that the inputted attributes were "LOAD=800" and "SPEED=120." While the attribute value input guide means 304 sets up such attribute value into the attribute model 106 in main storage 204, "finishing [a setup]" is set as the setting situation area of a value. Based on this input attribute value, processing will be performed like the above-mentioned demand pattern 1. It comes to be below explanation **** about the design procedure got by the **** last target for constraint networks which shows drawing 23 .

[0145] Constraint C5 starts first and "crevice d lower limit =220" is determined from an input attribute "SPEED=120." Next, constraint C3 starts and "a crevice d= 120" is set up. Then, constraint C1 starts and "cage depth =1150" and "cage width-of-face =1650" are computed from an input attribute "LOAD=800" (retrieval). Finally constraint C2 (hoistway dimension = crevice d*2+ cage width of face) can start, and an output attribute "hoistway dimension =2090" can be searched for from an input attribute "cage width-of-face =1650" and "a crevice d= 120."

[0146] It turns out that the design procedure which agreed in the demand "I want to know the minimum hoistway size which can arrange the device which only the basic specification of an elevator is known and fulfills a basic specification" of the operating person in charge who is a customer or a user by determining the sequence of constraint propagation based on the weight of constraint and an attribute is generated automatically also in the demand pattern 2 as mentioned above.

[0147] The design exchange equipment which enables the automatic generation of a design procedure according to various design patterns can provide by being able to generate automatically the design procedure corresponding to a specific demand pattern by determining the sequence of constraint propagation based on the weight of constraint and an attribute according to this example as explanation,

holding the weight data of constraint and an attribute for further two or more demand patterns of every above, replacing weight data if needed, and performing constraint propagation.

[0148] [Example 3] Drawing 36 explains the 3rd example of this invention from drawing 1 , drawing 2 , drawing 14 , and drawing 24 below. When the demand of a customer was inputted as a value of an attribute item by preparing each display screen which advances processing of the engineering-data-management section, a design-procedure flare part, and a design activation control unit by dialogue actuation with a user, it opts for a design procedure based on the modification propriety of the constraint knowledge between attribute items, or each attribute value and conflict occurs, this example guides a procedure and describes about the example acquired in the design proposal which fills a demand.

[0149] If this interactive mode design exchange method is started, the attribute value input guide means 304 of the engineering-data-management section will display new / registered housing data selection screen (drawing 24) on a display first. A menu 24-1 is chosen by whether he wants to change about what already has [that the operating engineer who is a user on this screen wants whether to design about a new housing, and] housing data. When **** is chosen, next, the attribute value input guide means 304 displays a control panel screen (drawing 25) on a display, and displays the inference mode selection menu 25-2, preservation / non-saving selection menu of design hysteresis information, and the display / non-display selection menu 25-2 of an inference activation trace screen, and the display / non-display selection menu 25-4 of a drawing menu on this screen. Moreover, the design strategy-management means of the engineering-data-management section displays the selection menu 25-1 of demand pattern No. on a control panel screen. If the operating engineer who is a user chooses a demand pattern, the design strategy-management means 315 will assign each attribute item and the weight data of constraint which have been registered for every demand pattern to the attribute and constraint in the model storage means for a design. Moreover, if a user chooses the value of inference mode, design hysteresis information, an inference activation trace screen, and a drawing menu next, each data will be set as a control section 301. Termination of a setup displays the attribute value input and the display screen 27-1 for a design on a display with the attribute value input guide means 304 of the engineering-data-management section.

[0150] Or it displays, after setting up the value which read registered housing data from the hysteresis database, and the attribute value input guide means 304 of the engineering-data-management section read to the attribute value input and the display screen 27-1 for [of a display] a design on new / registered housing data selection screen (drawing 24) when the operating engineer who is a user chose a registered housing.

[0151] Next, if a user clicks the attribute value column corresponding to the demand on an attribute value input and the display screen 27-1 when a user inputs the attribute value which a customer demands, the list of values with this selectable attribute value will be displayed as an alphabetic character 27-3, a range of number, or a drawing menu 27-6. If a value is chosen from this inside, the selected attribute value will be set as the attribute item to which the attribute model in the model storage means for a design corresponds. Moreover, about the thing a user wants to forbid modification of the value by inference to among input attribute value, if the lock/unlocking setting column 27-5 of this attribute is clicked, it will be set as a lock condition. If an attribute sees, the broth item list 27-4 is displayed as the input approach of attribute value here and a user chooses one of header entries of this, it can also perform displaying the attribute of this header entry on an attribute value input and the display screen 27-1. when inputting the attribute value about the configuration for a design furthermore, the attribute value which expresses the configuration pattern for a design first inputs — having (drawing 26) — it can also perform that correspond to which dimension of a configuration, or it is shown and the attribute corresponding to a demand of a customer guides with the dimension line 26-2 by displaying knot scale drawing 26 -1 registered beforehand.

[0152] After repeating this actuation and completing a demand input, a user clicks the inference activation command menu 27-2. Then, the engineering-data-management section makes automatic selection of the type of the model for a design used for generation of a design proposal corresponding to the inputted requirement specification. Next, it opts for a procedure for a design-procedure flare part to calculate a design solution with reference to the design situation which are the setting situation of attribute value, "a new setup of a value", "correction of a value" or "conflict generating", etc. for example, when a design situation is "a new setup of a value" The inside of the constraint knowledge which the constraint propagation execution sequence decision means of a design-procedure flare part is started, and is held at the model storage means for a design in the engineering-data-management section, With reference to the existence of a lock and unlocking assignment to attribute value [finishing / a setup] and attribute value, extract the constraint which can be started, and when two or more extracts are carried out Determine one

constraint which carries out new constraint propagation activation, and when a design situation is "correction of a value" Extract the constraint which can be further started by the existence of a lock and unlocking assignment to attribute value in relation to the attribute item which corrected the value, and when two or more extracts are carried out One constraint which carries out correction propagation activation is determined, and the attribute value relevant to a constraint name is transmitted to the design actuation activation section as data of a design procedure at the design actuation activation section. Here, when two or more extracts of the constraint which can be started are carried out, weight of the constraint which competes is compared and the constraint whose significance is size most is determined as a candidate for starting. Furthermore, when two or more constraint whose significance is size most exists, weight of the attribute item relevant to the constraint which competes is compared, and the constraint which can set up a more important attribute item is determined as a candidate for starting.

[0153] Based on the constraint directed from the design-procedure flare part, the design actuation activation section calculates a design solution, and stores a value in the engineering-data-management section. In the design actuation activation section, with a partial constraint propagation means, the value of an undecided attribute item is calculated by giving attribute value [finishing / a setup] to the attribute item of the parameter of constraint expressed with equality, and a result is stored in the attribute model in the model for a design of the engineering-data-management section. On a control panel screen (drawing 25), when the inference activation trace screen is set up with "the display" (25-3), an inference activation trace screen (drawing 28) is displayed, and the attribute value set up by inference/operation is indicated by sequential.

[0154] Moreover, when two or more combination occurs in attribute value during inference and the "sequential selection" is set up in the inference mode 25-2, display an attribute value selectable combination screen (drawing 29) on a display serially, a user is made to choose by the interactive mode, and attribute value is narrowed down from the candidate of combination. The combination of the selected attribute value is stored in the attribute model in the model for a design of the engineering-data-management section. Or when "candidate maintenance" is chosen in the inference mode 25-2, it holds to the range of each attribute in an attribute model as a candidate value, inference is continued to it, and the color of a candidate value is displayed on it in distinction from the inference termination back in the menu of the attribute value of an attribute value input and the display screen. Or with the candidate solution generation means 311, attribute value [finishing / a setup] is given to the attribute item of the parameter of constraint expressed on the table, the value of an undecided attribute item is searched, and the combination of attribute value is searched for. Consequently, when there is two or more combination, it is also possible to narrow down the combination of a candidate's attribute value from those interrelations in consideration of two or more constraint on a constraint network.

[0155] Or it confirms whether there is any combination of the attribute value same whether with the conflict check means 312, attribute value [finishing / a setup] is given to all the attribute items of the parameter of constraint expressed with equality, a table, or inequality, and equality and inequality are realized and in a table, and a result is stored in the attribute model in the model for a design of the engineering-data-management section. When the result of a conflict check is O.K., i.e., "nothing [conflict]", a design-procedure flare part will be performed if there is constraint in which constraint propagation activation is otherwise possible with attribute value including the newly set-up value. When the result of a conflict check is NG and a design situation is "conflict generating", the conflict generating message screen (drawing 30) which interrupts constraint propagation activation and carries out the message indicator of the contradictory contents of constraint is displayed. If a user clicks "a check" on this screen, the attribute value set up by inference until it arrives at conflict will be cleared. Or among constraint, constraint of the gestalt of the inequality showing the design basis "whether attribute value is larger than the permission minimum value" is checked at the last of constraint propagation activation, and a check result is displayed on a design proposal evaluation result screen (drawing 31 a and b).

[0156] If a procedure guide command menu is clicked in order that a user may acquire the approach of canceling conflict here, a procedure guide means is started, the attribute value modification approach for a conflict dissolution will be generated, a cure planning screen (drawing 32) will be displayed, a user will choose from the contents of the conflict dissolution, and attribute value will be changed. When there is no approach of a conflict dissolution, when a user judges by the interactive mode and performs constraint relaxation, the contents display screen of constraint relaxation (drawing 33) is displayed, and it chooses [automatic or] which constraint is eased to which level. By next, if the inference activation command menu 27-2 is clicked again, the design actuation activation section will correct attribute value, will store a value in an attribute model, will repeat this, and will generate a substitute design proposal.

[0157] Since design processing is interrupted when undecided attribute value still remains and there is no generating of conflict, he is urged to generate the attribute which can calculate most of other undecided attribute value in inputting a value, to display a question generation screen (drawing 34), and for a user to input the value of the attribute by the question generation function. A reply of a user sets a value as an attribute model. Constraint propagation is performed based on this. If a user clicks an examination Fig. display command menu when the above-mentioned processing is repeated and generating of conflict does not have the total attribute value in the model for a design a setting settled, the design proposal indicative-data generation means of the engineering-data-management section will display a design proposal display screen (drawing 36) on a display. Moreover, each attribute value distinguishes a color in an attribute value input and a display screen 34-1, and is displayed on it by what the user inputted, a default value, and the value set up by inference (drawing 35).

[0158] Moreover, it carries out being in the middle of a design, changing the attribute set and the constraint set which is the model for a design which the engineering-data-management section will use for generation of a design proposal if the attribute value about the structure pattern of a product is change, displaying the attribute-value input and the display screen after a change, following to a dynamic change of product structure, as the attribute-value input and the display which was able to took adjustment to the user can carry out, and continuing a design as it is possible.

[0159] If attribute value [finishing / a setup / already] is corrected according to this example as explanation above or it inputs a demand of a customer as a value of an attribute item by preparing each display screen which advances processing of the engineering-data-management section, a design-procedure flare part, and a design activation control unit by dialogue actuation with a user, based on the modification propriety of the constraint knowledge between attribute items, or each attribute value, it can opt for a design procedure and the design proposal which fills a demand can be obtained at an interactive mode. Moreover, since the execution sequence and direction of constraint are controlled using constraint significance or the significance of an attribute item, the design procedure according to various demand patterns can be generated automatically by using the significance data of the attribute and constraint registered for every demand pattern. Moreover, it is in the middle of a design, and if conflict occurs, the design exchange equipment which makes it possible to give a user the guidance about a design procedure and to design correctly and quickly by generating the alternative design proposal by the conflict dissolution approach or constraint relaxation can be offered.

[0160] [Example 4] Drawing 45 explains the 4th example of this invention from drawing 37 , drawing 38 , and drawing 39 below. Drawing 37 is the example of the software configuration for carrying out this example. Although it consists of a means in the software configuration Fig. fundamentally shown in drawing 3 , actuation of the part which clarifies epilogues and those relation along with the relation of the reference of between each means at the time of actuation, and serves as the description of this invention is explained. In drawing 37 , two or more weight data showing each attribute item and the significance for every constraint are registered, and it has the design strategy-management means 5001 which reads weight data according to the specified demand pattern, and is assigned to an attribute and constraint, and the composition of establishing the design-strategy knowledge 5002 which stores weight data. Moreover, it has the composition of establishing the service condition of constraint in the product structure knowledge 5011 which the model change means 315 for a design refers to, and the constraint knowledge 314. Moreover, it has composition which detailed the constraint propagation execution sequence decision means 307 for the constraint extract means 5005 which can be started, and the starting constraint judging means 5006. Moreover, it is what was detailed for a cure know-how advice means 5009 to advise on the cure for canceling conflict for the conflict dissolution means 308 by an expert's know-how, the cure know-how 5010 which a cure know-how advice means refers to and the constraint propagation hysteresis maintenance means 5007, and the back propagation means 5008. Moreover, drawing 38 is an outline flowchart.

[0161] Hereafter, actuation of this design exchange method is explained by making the case of an elevator into an example as one of the object products. The attribute value input screen displayed as initial value when the attribute item about the basic specification and basic structure for a design is displayed on an attribute value input area and the default is set as this attribute value by the input guide means 304 in this case, The attribute value which displays the menu of a customer's demand pattern and a user demands, if a demand pattern is chosen — having, when the value of the attribute Z as which the model change means 315 for a design expresses the classification of the product structure knowledge 5011, for example, "product structure, is Z1 The candidate for a design is expressed with the set of attributes A and B and C—, and the attribute set used for inference is changed based on the knowledge for activating the

attribute set which expresses the candidate for a design according to the classification of the product structure where it is expressed with an attribute B and D—" at the time of Z2. That is, the attribute data of this set is extracted from the attribute model knowledge base 313, and it develops on the attribute model 5003 which is the work area which stores the data of the attribute used for inference. When the value of the constraint service condition Y, for example, "attribute, is y by the attribute value to which the model change means 315 for a design furthermore makes a related attribute the attribute developed by the attribute model 5003 and which was restrained and inputted, The constraint to which it becomes good that constraint C1 (attribute A= attribute B+ attribute C) is used for inference" is extracted out of the constraint knowledge base 314, and it develops on the constraint knowledge 5004 which is the work area which stores the constraint data used for inference.

[0162] next, as the design strategy-management means 5001 described with the demand pattern which the user chose, for example, drawing 15, about the example of the demand pattern of the customer about an elevator 1) The attribute item which expresses the main functions of elevators, such as "the basic specification of an elevator, for example, "LOAD", and SPEED", beforehand on a customer side, And the standard device specification and layout specification whose building specification showing the building tooth space between elevators, such as a "hoistway" and "machine room", is known, and suited to the hoistway based on such attribute value are searched for.

[0163] 2) Only the basic specification of an elevator is known and I want to know the minimum hoistway size which can arrange the device which fulfills a basic specification.

[0164] It may have said. In order to generate the design procedure according to each automatically about the demand patterns 1 and 2, the significance of the constraint and the attribute corresponding to the value of a demand pattern is read from the design-strategy knowledge 5002, and significance is set as the attribute and constraint on the attribute model 5003 which is developing the attribute and constraint used for inference, and the constraint knowledge 5004. Moreover, the attribute value as which the input guide means 304 was inputted into the developed attribute is set up (from initiation to this processing corresponds to step 5101).

[0165] Initiation of inference of a user's selection extracts the constraint which can be started to the attribute value as which the constraint extract means 5005 which can be started was inputted. In the case of an extract, the starting gestalt (a set, check) of constraint is judged with the gestalt (formulas, such as a table, inequality) of each constraint, and the directivity which can be started. It judges as the constraint to which the extracted constraint which can be started should fulfill large constraint of the significance of a related attribute which is large constraint of significance more and determines a value based on the significance of the constraint and the attribute with which the starting constraint judging means 5006 is competing when those with two or more and contention occur, and tells to the partial constraint propagation means 310. Moreover, in spreading correction of attribute value, paying attention to the significance of the attribute relevant to constraint, what has a smaller significance is judged to be an important point correction attribute item, and it tells the partial constraint propagation means 310. With the partial constraint propagation means 310, the stereo of the constraint directed with the starting constraint judging means 5006 is read, and count of undecided attribute value and count of correction attribute value are performed according to a starting gestalt (from inference initiation to this processing is step 5102). Moreover, the constraint which conflict of the conflict detection means 312 during activation of partial constraint propagation generated is detected. When the conflict detection means 312 detects conflict, inference is interrupted and it warns a user of conflict having occurred. the case where a user chooses cure planning here — the cure know-how advice means 5009 — the cure know-how 5010 — for example

「IF 制約C2で矛盾 & 属性X > X1

THEN 製品構造ZをZ2に変更する

or

制約C2を緩和する

or

属性BをB2に変更する」

From the situation of the said constraint which conflict generated, and other attribute value, in order to cancel conflict, it advises on the modification approach of product structure, the relaxation approach of constraint, and the inputted modification approach of demand attribute value based on the cure know-how which an expert takes (step 5103).

[0166] When a user chooses modification of the attribute value showing product structure and changes the

attribute value of the product structure corresponding to this, according to a modification value, the model change means 315 for a design operates. While changing into an inactive condition the constraint relevant to the attribute no longer using for inference with the modification value of product structure based on the service condition in the product structure knowledge 5011 and the constraint knowledge base 314, and this, constraint which fulfills the service condition of constraint is made into an active state. The attribute and constraint set which changed as a result are developed on the attribute model 5003 and the constraint knowledge 5004. Activation initiation of the constraint propagation is carried out again after this.

[0167] Or when relaxation of constraint of a user is chosen, the constraint relaxation means 309 changes the relaxation level of the constraint which the user chose, and reruns constraint propagation after this.

[0168] Or when a user chooses correction of attribute value, the value it should extract in the input attribute relevant to the constraint which conflict of a constraint propagation hysteresis maintenance means 5007 to hold the hysteresis of the constraint propagation included also when the change of constraint and an attribute set occurs on the way generated, i.e., a conflict cause attribute, and the back propagation means 5008 should correct in this input attribute value is computed. A user chooses this adjusted value and starts constraint propagation again.

[0169] If it can be repeatedly found in the condition that there is no conflict of attribute value until all the attribute value that uses the above processing for inference is determined without conflict, the design solution display means 305 will display attribute value and the configuration for [corresponding] a design. If inference is completed with undecided attribute value remained, the question generation means 316 will generate the question to which the input of undecided attribute value is demanded from a user.

[0170] The design exchange method according to this invention as mentioned above can calculate a design solution, canceling [can carry out inference continuation, and] conflict quickly by the interactive mode, since incorporation of know-how is possible, also when the design procedure according to various demand patterns can be generated and it is accompanied by structural change.

[0171] Although a design solution is calculated in actuation of each above means, it describes further about the contents of each means.

[0172] About the model change means 315 for a design, the cage weight of the elevator of 1:1 roping presupposes that there was modification which increases sharply by the initial stage like drawing 39 as an example from which an attribute and a constraint set change. Although it is necessary to change into 2:1 roping since 1:1 roping and weight have constraint called application marginal weight, in the case of 2:1 roping, two pulleys for fishing a cage and a dead weight are newly needed. So, in order to perform constraint propagation succeeding and to advance a design, the item about a new pulley must be added to an attribute set and a constraint set. Moreover, the contents of constraint change also with the values which an attribute takes. For example, when the case where they are the case where a door format is 2S-2P (piece aperture) like drawing 40, and 2 P-CO (double door) is compared, as for the constraint about the amount L of heart gaps of a cage and a door, the contents differ, respectively. Then, the contents of constraint must be changed according to the value of a door format, and proper attribute value must be calculated by carrying out constraint propagation. moreover, since an intermediate beam will be add and the rail for dead weights will be attach when the clearance distance between a dead weight and a wall be vacant too much like drawing 41 as a result of inference, it be necessary to change to the set which added the attribute and constraint of specifications, such as size of an intermediate beam, and a format, or a location, and the model change means 315 for a design change the attribute and the constraint set which be able to took adjustment to the above-mentioned case.

[0173] Moreover, some level from which severity differs gradually about the constraint relaxation means 309 depending on constraint as shown in drawing 42 exists. For example, in "cage size selection constraint" in drawing, the large basis of selection of the selection range is gradually prepared by the works side, and when the selection range is the widest, it becomes the constraint of formula ["say / that it can adopt / if the product of cage width of face and depth is fixed / in proportion to burden / with every value / it"] type defined by JIS from the recommended value of "wanting to design with this value if it can do." In a technical examination process, to a change request with special cage size etc., it eases from severe constraint (recommended value) to loose constraint gradually, and a design solution is found out. Then, it enables it to register constraint hierarchical for example, according to relaxation level about the constraint in which the above relaxation is possible.

[0174] Moreover, in order to make the above-mentioned actuation perform, it can express like drawing 43 about the symbolic convention of the data of the attribute model 313. ** an attribute name, ** unit, ** form, and ** — range — the entry eye for controlling the value which attribute can take, ** default, ** classification, and a ** activation condition:attribute set. The conditions which an attribute is activated and

- are set as the object of constraint propagation are matched with the value of basic structure attributes (roping etc.), and are registered. About above **~**, all specification items to complete a design are extracted as an attribute, and are defined.

[0175] It can express still like [symbolic convention / of the constraint knowledge 314] drawing 44 . ** A constraint name, ** gestalt, ** application, ** starting directivity : in "with starting directivity" of constraint, give a definition with an output attribute name. ** Activation conditions : the entry eye for controlling a constraint set. The conditions which constraint is activated and are set as the object of constraint propagation are matched with the value of an attribute, and are registered.

[0176] ** Relaxation propriety : the entry eye which declares constraint which can be eased. The constraint stereo for every relaxation level is registered with the number of level which can be eased.

[0177] Moreover, the stereo data of constraint can be expressed, for example like drawing 45 as a related regulation between attributes. That is, it defines by either of five gestalten of formulas, such as a table and a table containing inequality, inequality, and design computation. In a constraint propagation process, as for the starting gestalt of constraint, a starting gestalt also changes with differences in the application with two kind of an I set (attribute value is set up using constraint) RO check (constraint is filled or it judges from set up attribute value). For example, in default setting constraint, when there is no input of a user, standard attribute value is set up, but it is not contradictory even if this constraint is not filled. On the other hand, in device specification selection or layout decision constraint, attribute value is determined (set), and constraint is always checked as surely filled.

[0178] Drawing 50 explains the 5th example of this invention from drawing 46 to below the [example 5].

When conflict occurs in constraint propagation, this example directs the modification approach of attribute value with the cure know-how advice means 5009 and the attribute which should be changed is directed using an expert's qualitative know-how, It is related with the dissolution approach of the conflict in the constraint propagation including the constraint from which the contents of constraint change with the value of an attribute especially about calculating the adjusted value of an attribute to search for the cause of conflict on the hysteresis of constraint propagation, and solve the conflict.

[0179] Usually, since it only has the hysteresis of constraint propagation to the variable which is the attribute which the value decided and does not have the hysteresis of a change of the contents of constraint, when searching for the cause of conflict using the hysteresis of constraint propagation, it was not taken into consideration about the variable which has changed the contents of constraint, but the problem that where of it cannot ask considering the variable which has changed the contents of constraint as a cause of conflict was.

[0180] Moreover, in order that it might not be considered by how said variable called for only by asking for either should be changed but the variable constituting the cause of conflict of constraint propagation might cancel conflict, there was a problem that the value of the variable called for as a cause had to be changed by trial and error, and had to be tried.

[0181] This example aims at following the hysteresis of constraint propagation, asking for the input variable of the cause of conflict, and calculating the value of the conflict cause variable in which a conflict dissolution is possible from the conflict generated in process of constraint propagation, in order to solve the above problems.

[0182] A "constraint propagation means" by which this example performs constraint propagation in order to attain the above-mentioned purpose, Each hysteresis of the "constraint change means" and the "constraint propagation means" which change the contents of constraint, and a "constraint change means" is recorded. The "constraint propagation hysteresis maintenance means" to hold, a "constraint change hysteresis maintenance means", The "constraint propagation historical data" generated by the "constraint propagation hysteresis maintenance means", It is carrying out as the configuration prepare the "constraint change historical data" generated by the "constraint change hysteresis maintenance means", and a "constraint back propagation means" to follow the direction of constraint propagation to hard flow based on "constraint propagation historical data" and "constraint change historical data", and to ask the conflict dissolution approach in quest of the cause of conflict at the time of conflict generating.

[0183] Thereby, the change hysteresis of the contents of constraint by the "constraint change means" can also be held now with a "constraint change hysteresis maintenance means" ("constraint change historical data"), and the "constraint back propagation means" makes it possible to ask also for the variable which has changed the contents of constraint as a cause of conflict.

[0184] Moreover, the "constraint back propagation means" makes it possible to follow the hysteresis of constraint propagation to constraint propagation and hard flow, and to ask for the cause variable of conflict, and to calculate the value of the conflict cause variable which spreads a value to the direction and

hard flow of value propagation of constraint propagation, and can cancel conflict. By these, this invention can calculate a conflict cause variable and its conflict dissolution possible value from the conflict generated in process of constraint propagation.

[0185] The block diagram of this example is shown in drawing 46. In drawing 46 7101 "a variable data" The data of the definite condition of the value of a variable, and a value, The data in which the contents of the constraint whose 7102 "constraint data" is a related regulation between variables are shown, The means which 7103 "a constraint propagation means" reads the contents of constraint from the definite condition of 7101 to a variable, a value, and 7102, decides the value of an undecided variable, and is written in 7101, The means which 7104 "a constraint change means" reads the value of a variable, and the data of the constraint from 7102 from 7101, changes the contents of constraint, and is written in 7102, The means which writes the variable which needs 7105 "a constraint propagation hysteresis maintenance means" for the constraint and decision which decided the value when the value of a variable was decided by 7104, and the fixed variable in 7107, The means which 7106 "a constraint change hysteresis maintenance means" makes hysteresis the variable which became the conditions of a change when the contents of constraint were changed by 7103, and constraint which changed, and is written in 7107, The data with which 7107 "constraint propagation historical data" was written in by 7106, They are the data with which 7108 "constraint change historical data" was written in by 7105, and a means for 7109 to follow constraint and a variable to the direction and hard flow of value propagation of constraint propagation using the data of 7107 and 7108, and to spread a value to the direction and hard flow of value propagation of constraint propagation.

[0186] The flow chart with which procedure is expressed to drawing 47 is shown. It is shown how the above-mentioned purpose is attained using drawing 47.

[0187] Initial value is first inputted into a variable from the outside, and the value of the inputted variable is decided (7201). If there are some which can perform a "constraint propagation means" and a "constraint change means" using the fixed variable, it will perform (7202 7203). a "constraint propagation means" performs — having (7203) — the value of an undecided variable is decided and a "constraint propagation hysteresis maintenance means" records hysteresis for the hysteresis on "constraint propagation historical data" (7207). a "constraint change means" performs — having (7202) — the contents of constraint change and a "constraint change hysteresis maintenance means" records hysteresis for the hysteresis on "constraint change historical data" (7206). If a "constraint propagation means" or a "constraint change means" is performed, it will inspect by whether conflict has occurred (7208). If conflict has not occurred in inspection, it returns to processing of a "constraint propagation means" and a "constraint change means." If it is found that conflict has occurred in inspection, a "constraint back propagation means" will be started (7209).

[0188] First let the variable currently recorded on hysteresis as a variable required for decision of the variable in search of the hysteresis which decided the contradictory value of a variable from "constraint propagation historical data" be a temporary conflict cause variable with a "constraint back propagation means." Moreover, the constraint which has decided the variable of the hysteresis looks for whether the contents of constraint have changed in "constraint change historical data", and when you have changed, also let the variable used as the conditions of a change be a temporary conflict cause variable. It carries out by repeating processing of a "constraint back propagation means" about each variable leading to [temporary] conflict, and processing followed to the direction and hard flow of value propagation of constraint propagation is performed. When the hysteresis which has decided the temporary conflict cause variable stops finding, let the temporary conflict cause variable be a conflict cause variable.

[0189] Processing of the above "a constraint back propagation means" fulfills constraint for the value of the temporary conflict cause variable which can cancel conflict to the direction and hard flow of value propagation of constraint propagation in parallel, and calculates the value of a temporary conflict cause variable.

[0190] If all processings of a "constraint back propagation means" are completed, the found conflict cause variable and each value which can carry out a conflict dissolution will be shown (7210), the value of the variable which carries out a conflict dissolution will be again inputted from the outside (7211), and it will return to processing of a "constraint propagation means" and a "constraint change means" again.

[0191] It repeats until the processing which performs this whole processing with a "constraint propagation means" and a "constraint change means" is lost.

[0192] In constraint relation including the constraint relation shown in drawing 48, the case where conflict occurs during constraint propagation is explained. In drawing 48 7301 Variable A and 7303 for Variable X and 7302 Variable B When 7304 is expressed by constraint between Variables A and B and C by Variable

C, 7305 is expressed with a formula, $C=A+B$ and 7306 are expressed by constraint between Variables A and B and C by the formula and $C=A-B$ and 7307 make 7305 or 7306 the contents of constraint with Variable X, they are Variables A and B and constraint between C. It is the relation which changes the contents of constraint 7307, 7308 considers as the contents of constraint of 7305, when the value of Variable X is zero or more, and when the value of Variable X is less than zero, it is taken as the contents of constraint of 7306.

[0193] Constraint propagation is performed as follows.

[0194] (1) When variable $X=-10$ were inputted from the outside and the value was decided, the contents of constraint 7307 serve as a formula 7306 with a "constraint change means."

[0195] (2) Variables A and B are also inputted from the outside and are decided with $A=200$ and $B=100$.

(3) constraint 7307 performs with a "constraint propagation means" by having decided Variables A and B — having — $C=A-B$ It is set to $B=200-100=100$ and decides with a variable $C=100$.

[0196] (4) Constraint propagation is succeedingly performed by having decided the value of Variable C.

(5) In the hysteresis of the constraint propagation only on the constraint relation of drawing 48 by processing of (1) and (2), "constraint propagation historical data" becomes drawing 49, and "constraint change historical data" becomes drawing 50.

[0197] Suppose that conflict occurred in process of this constraint propagation. A "constraint back propagation means" is started from the variable which conflict generated. When followed to hard flow, the variable C of the constraint-related inside of drawing 46 turned into a temporary conflict cause variable. Moreover, the conflict dissolution possible value in Variable C is 300. Previous processing of a "constraint back propagation means" is shown below from there.

[0198] (7) When the constraint which decided the value of Variable C is looked for from the above "constraint propagation historical data", it turns out that it is constraint 7307. Variables A and B are the cause. Let these variables A and B be temporary conflict cause variables.

[0199] (8) When the hysteresis which decided the contents of constraint 7307 is looked for from the above "constraint change historical data", it turns out that Variables X are the conditions of contents decision. Let this variable X be a temporary conflict cause variable.

[0200] (9) (7) and (8) show that the value of Variable C is decided by Variables A, B, and X. And since there is no other constraint which has decided the value of these 3 variable, it turns out that these three variables are the causes of conflict (since it is inputted from the outside).

[0201] (10) The conflict dissolution possible value in Variable C is 300. Here, since Variables A, B, and X are a temporary conflict cause variable on the constraint relation of drawing 48, the value for canceling conflict is calculated to these three variables. The formula 7306 of constraint 7307 is transformed first and it is $C=A-B$. $A-B=C$ It can B Come and Variable A is $A=\text{more}$. $C+B$ It is set to $B=300+100=400$ and it turns out that a conflict dissolution is possible at the time of $A=400$. Similarly, Variable B is $B=A-C$. It is set to $C=200-300=-100$ and it turns out that a conflict dissolution is possible at the time of $B=-100$.

[0202] Next, a conflict dissolution possible value is calculated about Variable X.

[0203]

$X = \text{more than } 0$: — the contents of constraint 7307 — formula $7305C = A + \text{less than } [B300=200]$

$+100X0$: — the contents of constraint 7307 — formula (current constraint)

$C = A - B$ If $B300 \neq 200-100=100X$ is calculated, it is as mentioned above, and when X is zero or more, there is no conflict and it can calculate. As mentioned above, it turns out that the dissolution of conflict is possible at the time of either of $A=400B=-100X \geq 0$.

[0204] [An example 6], next the same example 6 are shown. It is the variable of drawing 51, and the relation of constraint, and is the example of a constraint propagation method **** case. The "constraint propagation historical data" when performing constraint propagation in this example becomes drawing 52, and "constraint change historical data" becomes drawing 53. The example of the processing followed to the reverse of a "constraint back propagation means" when conflict occurs with a variable P10 during constraint propagation is shown below.

[0205] (1) Look for the hysteresis which decided the value of a variable P10 from "constraint propagation historical data."

[0206] (2) The value of a variable P10 is decided by constraint C5, and it shows that the required variable is P9. Let a variable P9 be a temporary conflict cause variable.

[0207] If "constraint propagation historical data" is looked for, constraint C4 will find the hysteresis which decided the temporary conflict cause variable P9 like (3) and (2), and let the variables P5 and P7 which were required for it be temporary conflict cause variables.

[0208] (4) Since constraint C4 is on "constraint change historical data", it also makes the variable P6 used

as the conditions of a change a temporary conflict cause variable.

[0209] The temporary conflict cause variables P5, P7, and P6 are looked for from hysteresis like (5) and (2). P5 and P6 — respectively — constraint C1 — since the value is decided as be alike C2, let each need variable P1, P2, and P3 be a temporary conflict cause variable.

[0210] (6) Since there is no hysteresis which has decided the value of the temporary conflict cause variable P7 in "constraint propagation historical data", let a variable P7 be a conflict cause variable.

[0211] Although the hysteresis which has decided the value of the temporary conflict cause variables P1, P2, and P3 like (7) and (2) is looked for from "constraint propagation historical data", since it is not found, let variables P1, P2, and P3 be conflict cause variables.

[0212] (8) The above processing shows that conflict cause variables are P7, P1, P2, and P3.

[0213] Conflict calculates a dissolution possible value like an example 1 about the value of these four variables.

[0214] As mentioned above, even if conflict occurs in the design exchange method by this invention, the cause of the conflict can be searched for and it becomes possible to also show the dissolution approach.

[0215] Moreover, there is also a method of repeating making undecided the value of the variable which caused conflict as an approach of canceling conflict, and making undecided the variable based on hysteresis decided with the variable undecided.

[0216] Drawing 59 explains the example 7 of this invention from drawing 54 to below the [example 7].

[0217] Drawing 54 is the outline functional block diagram showing one example of the design exchange equipment which has a design data input exchange method by this invention. Knot scale graphic data and 8108 are [8105 / the model for a design with which the demand attribute-value input means which 8101 stores the attribute model and the constraint knowledge of the model for a design in drawing 54 , and inputs attribute value, a design solution output means to by which 8102 outputs the design solution of design inference / the result of an operation, and 8103 consist of a design inference / operation means, and 8104 consists of an attribute model and a rule of inference, and / 8106 / a knot scale graphic-display means and] a knot scale graphic-data registration means in a knot scale graphic form retrieval means and 8107.

[0218] Drawing 55 is the example of the hardware configuration for functioning drawing 54 . For a display and 8203, as for a mouse and 8205, in drawing 55 , a keyboard and 8204 are [8201 / a workstation and 8202 / a printer and 8206] external storage.

[0219] Drawing 56 is the example of a flow chart of the software for functioning drawing 54 . An attribute value input means generates the input menu of attribute value first. Based on this, the customer inputs the attribute value to demand. If a value is inputted into the attribute which expresses the configuration pattern for a design at this time, knot scale graphic form display processing will be started.

[0220] Then, termination of the input of a demand performs inference/operation. When there is conflict, the message indicator of the purport which cannot take adjustment is carried out. Moreover, when there is no conflict and all design attribute value can be found, a result is outputted with a design solution output means. When undecided attribute value remains, an input or an inference operation is repeated.

[0221] Next, knot scale graphic form display processing is explained using drawing 57 . Knot scale graphic data are searched by using as a key attribute value showing the configuration pattern with which the knot scale graphic form retrieval means was set up first. Next, a screen display of the data with which the knot scale graphic-display means was searched is carried out. If a user clicks the attribute item of a demand attribute value input screen here, the dimension in the knot scale graphic form corresponding to an attribute will be displayed as the dimension line (drawing 59). The searched knot scale graphic form is displayed until the attribute value of a configuration pattern is changed after this. Modification redoes retrieval processing and display processing. A screen is ended at the time of a shutdown.

[0222] The example of knot scale graphic data is shown in drawing 58 . Arrangement and the attribute of an arrangement pattern of the model for a design are defined, and the correspondence relation between the dimension in configuration data and the attribute name corresponding to the dimension is registered for every arrangement pattern. While the basic structure for a design can be searched by the ability using arrangement pattern No. as a key by this although it is a knot scale, and a user can check visually, he can also understand correspondence of each attribute and a dimension easily.

[0223] Moreover, in this design data input exchange method, knot scale graphic data can be easily built by providing further a knot scale graphic-data registration means to register knot scale graphic data, graphic data, correspondence of an attribute subject name, and the retrieval conditions of a knot scale graphic form.

[0224] Drawing 68 explains the example 8 of this invention from drawing 60 to below the [example 8].

[0225] Drawing 61 is the block diagram showing one example of the computer-aided design which realizes the constraint management method by this invention. In drawing 61, 9201, 9202, and 9203 are one design exchange equipment by a workstation etc., 9210 is a file server for sharing [which came to ease the result, the eased constraint, and constraint relaxation level and a constraint in the middle of the design solution or the design] the information about a design intention, and 9211 is a network for exchanging information with a file server and design exchange equipment.

[0226] An attribute value input means for drawing 60 to be drawing having shown the functional configuration of a constraint management method, and for 9101 input the attribute value which a customer demands, The attribute value storage section which memorizes the specification for [as which 9102 was expressed as attribute value] a design, A design solution output means to output a result with the means of a drawing etc. based on the attribute value 9103 is remembered to be by the attribute value storage section in the middle of a design solution or a design, The constraint knowledge base where 9104 stores constraint between attributes, the active constraint knowledge base which memorizes constraint with 9105 [effective now], A constraint relaxation means for 9106 to take out constraint effective now among the constraint stored in the constraint knowledge base, and to set it as the active constraint knowledge base, 9107 And a constraint propagation means for non-set up attribute value to ask based on the active constraint knowledge base from attribute value [finishing / a setup / in checking the existence of conflict between attribute value], and to set a value as the attribute value storage section, A conflict display means to display the contents when 9108 has conflict between attribute value, A constraint relaxation directions input means by which he inputs constraint relaxation directions by checking conflict between attribute value by the conflict display means, as for 9109 when a designer judges that constraint eases, The constraint relaxation level storage section which memorizes constraint relaxation level based on the constraint relaxation directions into which 9110 was inputted from the constraint relaxation directions input means, A design intention input means by which, as for 9111, he inputs the design intention when a designer judges that constraint eases, The design intention storage section which memorizes design intention that 9112 was inputted by the design intention input means, 9113 is a radial transfer means for relating for every result in the middle of each design solution or a design, taking out from a file server or storing the value of each attribute, the constraint relaxation level of each constraint, and a design intention. These are all given in design exchange equipment.

[0227] It is the constraint relaxation level storing section which stores in the contents of the constraint which eased as the result storing section and 9122 obtained a result in the middle of a design solution or a design a design solution / in the middle of the design in which 9121 stores a result in the middle of the design solution to which a design was carried out using design exchange equipment, or a design, and the design intention storing section memorize the design intention 9123 eased constraint, and it relates for every result in the middle of each design solution or a design, and these are stored in a file server.

[0228] Drawing 62 is the example of the hardware configuration for carrying out the means of drawing 61. In drawing 62, 9301 thru/or 9306 constitute design exchange equipment. The system unit of a workstation and 9302 9301 A display unit, The printer by which a keyboard and 9304 output a mouse and, as for 9305, 9303 outputs a design solution, 9311 for 9306 to store the constraint knowledge base thru/or 9316 constitute a file server. The system unit of a workstation and 9312 9311 A display unit, 9313 is external storage for a mouse and 9315 to store a printer and for 9316 store the result storing section, the constraint relaxation level storing section, and the design intention storing section a design solution / in the middle of a design, as for a keyboard and 9314.

[0229] Hereafter, the case where an object product is made into an elevator is explained as an example. Drawing 63 expresses the configuration of an elevator. An elevator mainly consists of the "arm shaft counterbalance" and the "cage" which were tied with the rope in order to take the "cage", the "cage", and equilibrium which put people and a load, and a "loop wheel machine" which makes a "arm shaft counterbalance" go up and down, and these are arranged in a "hoistway" and "machine room." The "hoistway frontage", "hoistway depth" whose structures of an elevator are the frontage dimension of the "hoistway" in which an elevator is installed in a building, and a depth dimension, So that it may be suitable to the attribute value which the customer the "movable load" which is the possible weight of putting on ** "a cage" demands "cage which are the "cage inside distance frontage" and the "cage inside distance depth" which are each PERT's attribute value, i.e., the frontage dimension inside a "cage", and a depth dimension, the frontage dimension of the outside of a "cage", and a depth dimension — an outer slope — frontage" and "cage — an outer slope — it is decided by setting up attribute value, such as depth." Constraint is expressed with the table showing the combination which should be fulfilled among two or more attribute value, a formula, inequality, etc. The contents of each constraint of an example of the

'relation between an attribute item and constraint to drawing 65 are shown in drawing 64 .

[0230] For example, constraint 1 shows the table of the combination which was able to take the adjustment of the value of a "movable load", a "cage inside distance frontage", and "cage inside distance depth." Constraint 2 and constraint 3 are the constraint which should be filled for the thickness of a "cage" side plate, and are the constraint which should be filled in order that a "cage" and a "dead weight" may go up and down constraint 4 and constraint 5, without colliding with a "hoistway." With the constraint propagation means 107, a setup of which attribute value under constraint uses these constraint in both directions, as it said that other attribute value under constraint was calculated automatically. For example, when a "movable load" is set up with "1050kg" by constraint 1, The value of a "cage inside distance frontage" and "cage inside distance depth" is respectively decided as "1900mm" and "1300mm", and a value is set up automatically. Conversely, when the value of a "cage inside distance frontage" and "cage inside distance depth" is respectively set up with "1550mm" and "1100mm", a "movable load" is decided as "700kg" and a value is set up automatically. if a "cage inside distance frontage" and "cage inside distance depth" are decided also about constraint 2 and constraint 3 — automatic — "cage — an outer slope — frontage" and "cage — an outer slope — depth" is calculated and a value is set up. conversely, "cage — an outer slope — frontage" and "cage — an outer slope — if depth" is decided, a "cage inside distance frontage" and "cage inside distance depth" will be calculated automatically, and a value will be set up. moreover — constraint 4 and constraint 5 — "cage — an outer slope — frontage" and "cage — an outer slope — when the value of depth" is set up and a "hoistway frontage" and "hoistway depth" are already set up, it checks whether inequality is realized. Moreover, about constraint 1, when standard constraint is expressed and a design solution is not acquired in this combination, with the constraint relaxation means 9108, especially the combination of the value of drawing 65 eases constraint to non-standard constraint as shown in drawing 66 , and continues a design.

[0231] The constraint relaxation level storage section memorizes relaxation level so much for a constraint number like drawing 67 like a criterion (with no constraint relaxation), non-standard [n] (n level relaxation), and removal (all constraint relaxation). Moreover, in the design intention storage section, the reason of the relaxation about the eased constraint is memorized like drawing 68 like being "lack" of on the strength, customer being "assignment", and "an object configuration being special." At the time of design termination or interruption, through a radial transfer means, the information on the attribute value storage section, the constraint relaxation level storage section, and the design intention storage section is associated mutually, and is stored in the result storing section, the constraint relaxation level storing section, and the design intention storing section a design solution / in the middle of a design.

[0232] In correcting a design solution or continuing a design using a result in the middle of a design solution or a design A radial transfer means is minded from each design exchange equipment. In the middle of a design solution or a design with the data of a result Since the data in which a design intention is shown [which came to ease the constraint eased in order to draw a result in the middle of the design solution or a design and relaxation level, and a constraint] are transmitted to each design exchange equipment It is possible to correct a design solution or to continue a design, without the contents of decision making made at the time of a former design and decision disappearing.

[0233] [Example 9] Drawing 69 and drawing 70 explain the 9th example of this invention below. This example explains a candidate solution generation means 311 to output the candidate of all the design solutions that can be taken, to a demand. the constraint network top of drawing 69 — if 2500 is inputted into 950 and a hoistway frontage dimension and 1670 is inputted [LOAD / SPEED] into 1100 and the entrance heart at 150 and entrance width of face, constraint C1 will start based on constraint of drawing 7 — having — the cage inside distance W and inside distance D — in or (1650 1350) (1850 1250), the combination which can be taken occurs. When constraint propagation is respectively continued in 2 sets of these combination and conflict is generated on the way, the candidate solution generation means 311 cancels that combination, and outputs that with which inference was performed without generating conflict, and it was decided that a design solution would be as a candidate solution like drawing 70 . Thereby, a user makes it possible to choose the thing nearest to hope as a design solution from candidate solutions.

[0234] Drawing 71 explains the example 10 of this invention to below the [example 10].

[0235] Drawing 71 is the block diagram showing one example of the computer-aided design which realizes the design exchange method by this invention. By arranging the design exchange equipment which consists of a function of this invention in drawing 71 into a operating technical section, based on a customer's requirement specification, since examination of a device specification and the layout specification of each device can carry out interactively through the guide of a design procedure, and know-how advice, it can compute a design solution quickly. a design solution — as an installation drawing — outputting — a

customer — showing . After acquiring the approval of a customer, manufacture arrangements are carried out through a network at a works side.

[0236]

[Effect of the Invention] According to this invention, the design solution with which a demand of a customer is filled is efficiently generable by determining the attribute value of a product automatically about the product with the variation of various attribute items and attribute value based on constraint, guiding a procedure, when the engineering-data-management section, and a design-procedure flare part and the design actuation activation section interlock.

[0237] Moreover, since the design procedure according to various demand patterns can be generated automatically about a product which has variety in a demand of a customer, and a specification item especially important for whenever [the] is changed, and changes the procedure of a design, the design solution with which a demand of a customer is filled is efficiently generable.

[0238] Moreover, to modification of attribute value [finishing / a setup / already], it can respond by correction propagation and a design proposal can be corrected correctly and quickly.

[0239] Moreover, since a possible candidate design proposal is generable to a demand, a user can know various possibility.

[0240] Moreover, since constraint can be eased in the middle of propagation of constraint and a substitute design proposal can be generated to it when a conflict dissolution is not able to be shown when conflict occurs, or it is not able to cancel, when it is not able to respond to a demand of a customer, a cause, a cure, and an alternative plan can be known easily.

[0241] Moreover, when constraint propagation is interrupted on the way by question generation, the attribute value which should be inputted further is shown, and it makes it easy that a user does design continuation, and makes it possible to perform a quick design.

[0242] Moreover, it is possible to continue a design by changing the set of constraint to the attribute used for generation of a design proposal automatically corresponding to modification of the attribute value about the product structure in the middle of a design, and generating of conflict.

[0243] Moreover, since the design procedure according to this demand pattern can be generated automatically based on demand pattern No. chosen as the user on the control panel screen about a product which has variety in a demand of a customer, and a specification item especially important for whenever [the] is changed, and changes the procedure of a design, the design solution with which a demand of a customer is filled is efficiently generable.

[0244] Moreover, if attribute value [finishing / a setup / already] is changed on an attribute value input and the display screen and an inference activation command menu is chosen, correction propagation is performed and a design proposal can be corrected correctly and quickly.

[0245] Moreover, since a possible candidate design proposal can be generated and displayed to a demand, while a user gets to know various possibility, a user can narrow down a candidate.

[0246] Moreover, since the contents of the constraint to ease can be displayed and a substitute design proposal can be generated when the attribute value modification approach for carrying out a conflict dissolution is not able to be displayed in the middle of propagation of constraint when conflict occurs, or it is not able to cancel, when it is not able to respond to a demand of a customer, a cause, a cure, and an alternative plan can be known easily.

[0247] Moreover, when constraint propagation is interrupted on the way by question generation, the attribute value which should be inputted further is displayed, and it makes it easy that a user does design continuation, and makes it possible to perform a quick design.

[0248] Moreover, it is possible to continue a design by changing the set of constraint to the attribute used for generation of a design proposal automatically corresponding to modification of the attribute value about the product structure in the middle of a design, and generating of conflict, and maintaining the adjustment of the menu of an attribute value input and the display screen.

[0249] Thus, a operating engineer can respond to a demand of a customer promptly, can present a result, and can aim at improvement in a customer response.

[0250] Moreover, also in the constraint propagation method which has the constraint which changes the contents during constraint propagation, it can ask to be able to ask for the variable leading to the conflict to generate, and for conflict to be able to cancel the value of a conflict cause variable.

[0251] If the attribute value about the basic structure of expressing the configuration pattern of the model for a design is inputted in a demand attribute value input according to this invention When a knot scale graphic form is displayed and a user clicks the attribute name column of an attribute value input and a display screen, each attribute item in the above-mentioned attribute model A user can check now easily

the contents of the attribute which it is going to input to which dimension of the configuration of the model for a design it corresponds, and by judging and establishing a knot scale graphic-display means to display the dimension line for a configuration and a color in distinction from a knot scale Fig. top.

[0252] Moreover, knot scale graphic data can be easily built now by establishing a knot scale graphic-data registration means to register knot scale graphic data, graphic data, correspondence of an attribute subject name, and the retrieval conditions of a knot scale graphic form.

[0253] Designing quickly as mentioned above is possible. A operating engineer can respond to a demand of a customer promptly, can present a result, and can aim at improvement in a customer response.

[0254] When correcting a design solution or continuing a design using a result in the middle of a design solution or a design according to this invention there is nothing at the time of a former design, without the contents of ***** and decision disappearing ** [be / an efficient design / possible] since a design solution can be corrected or a design can be continued using the design intention which performed [which came to obtain the result in the middle of the design solution or a design] the eased constraint and relaxation level, and constraint relaxation.

[Translation done.]

* NOTICES *

JPO and NCIP are not responsible for any damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.**** shows the word which can not be translated.

3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the functional block diagram showing one example of the design exchange method by this invention.

[Drawing 2] It is the hardware configuration Fig. showing the use gestalt of the equipment of drawing 1 .

[Drawing 3] It is the configuration of a means of design exchange equipment to have the approach of drawing 1 .

[Drawing 4] It is the explanatory view of the attribute model knowledge base of an elevator, and the constraint knowledge base.

[Drawing 5] They are the attribute model of an elevator, and the explanatory view of correspondence of a configuration.

[Drawing 6] It is the contents explanatory view of each attribute item in an attribute model.

[Drawing 7] It is the contents explanatory view of constraint knowledge.

[Drawing 8] It is drawing of the managed table of constraint starting conditions.

[Drawing 9] It is drawing showing the condition that the initial value by the constraint network was inputted.

[Drawing 10] It is drawing of the condition of the obtained constraint network after constraint propagation activation of constraint C1.

[Drawing 11] It is drawing of the condition of the constraint network obtained by activation of partial constraint propagation of constraint C5 and constraint C6.

[Drawing 12] It is drawing of the example of correction propagation.

[Drawing 13] It is the explanatory view of the configuration of an elevator.

[Drawing 14] It is the configuration of the means of the design exchange equipment in the 2nd example.

[Drawing 15] It is drawing showing the example of a demand pattern.

[Drawing 16] It is the contents explanatory view of each attribute item in the attribute model in the 2nd example.

[Drawing 17] It is the contents explanatory view of the constraint knowledge in the 2nd example.

- [Drawing 18] It is drawing of the managed table of the constraint starting conditions in the 2nd example.
- [Drawing 19] It is the maintenance condition explanatory view of the constraint stereo in the 2nd example.
- [Drawing 20] It is drawing of the design strategy-management table in the 2nd example.
- [Drawing 21] It is drawing showing the constraint network of the demand pattern 1 in the 2nd example.
- [Drawing 22] The constraint propagation execution sequence decision flow in the 2nd example.
- [Drawing 23] It is drawing showing the constraint network of the demand pattern 2 in the 2nd example.
- [Drawing 24] They are new / registered housing data selection screen.
- [Drawing 25] It is a control panel screen.
- [Drawing 26] It is a knot scale screen for an attribute value input.
- [Drawing 27] They are an attribute value input and the display screen, and the screen of an attribute value input menu and the command menu of each functional activation.
- [Drawing 28] It is an inference activation trace screen.
- [Drawing 29] It is an attribute value selectable combination screen.
- [Drawing 30] It is a conflict generating message screen.
- [Drawing 31] It is a design proposal evaluation result screen.
- [Drawing 32] It is a cure planning screen.
- [Drawing 33] It is the contents display screen of constraint relaxation.
- [Drawing 34] It is a question generation screen.
- [Drawing 35] They are the attribute value input and the display screen of a design result.
- [Drawing 36] It is the design proposal display screen.
- [Drawing 37] It is the block diagram into which the view of the functional configuration of drawing 1 was changed.
- [Drawing 38] It is the outline flowchart of the block diagram of drawing 37 .
- [Drawing 39] It is the example of a model change of an attribute set.
- [Drawing 40] It is the example of a model change of a constraint set.
- [Drawing 41] In order to cancel the conflict which occurred during constraint propagation, it is the example of the cure know-how which directs modification of product structure.
- [Drawing 42] It is the contents Fig. of constraint relaxation.
- [Drawing 43] It is a description format of attribute data.
- [Drawing 44] It is a description format of constraint knowledge.
- [Drawing 45] It is drawing showing the conditions which can start constraint.
- [Drawing 46] It is the block diagram of the constraint propagation method by this invention.
- [Drawing 47] It is the processing flow chart of the constraint propagation method by this invention.
- [Drawing 48] It is drawing showing the constraint for explaining the example 5 of this invention, and the relation of a variable.
- [Drawing 49] It is the "constraint propagation historical data" of an example 5.
- [Drawing 50] It is the "constraint change historical data" of an example 5.
- [Drawing 51] It is drawing showing the constraint for explaining the example 6 of this invention, and the relation of a variable.
- [Drawing 52] It is the "constraint propagation historical data" of an example 6.
- [Drawing 53] It is the "constraint change historical data" of an example 6.
- [Drawing 54] It is the functional block diagram showing one example of the design data input exchange method by this invention.
- [Drawing 55] It is the hardware configuration Fig. showing the use gestalt of the equipment of drawing 1 .
- [Drawing 56] It is the flow chart of the design data input exchange method which has the approach of drawing 1 .
- [Drawing 57] It is the flow chart of a knot scale graphic form display process.
- [Drawing 58] It is the configuration of knot scale graphic data.
- [Drawing 59] It is the knot scale Fig. display screen.
- [Drawing 60] It is the functional block diagram showing one example of the constraint management method by this invention.
- [Drawing 61] It is the design exchange structure-of-a-system Fig. which realizes drawing 60 .
- [Drawing 62] They are the design exchange equipment of drawing 61 , and the hardware configuration Fig. of a file server.
- [Drawing 63] It is the explanatory view of the configuration of an elevator.
- [Drawing 64] It is the explanatory view of constraint between the attributes of an elevator.
- [Drawing 65] It is the contents explanatory view of each constraint in the constraint knowledge base.

[Drawing 66] It is the contents explanatory view of the non-standard constraint about the constraint 1 of drawing 65 .

[Drawing 67] It is the block diagram of the constraint relaxation level storage section.

[Drawing 68] It is the block diagram of the design intention storing section.

[Drawing 69] It is an attribute candidate example value in the case of performing candidate solution generation.

[Drawing 70] It is the output of the select mortality table by generation of a candidate solution.

[Drawing 71] The employment gestalt of this design exchange method is expressed.

[Description of Notations]

- 101 — Engineering-data-management section,
- 102 — Attribute value input guide function,
- 103 — Design proposal display means,
- 104 — Model for a design,
- 105 — Constraint knowledge,
- 106 — Attribute model,
- 107 — Design-procedure flare part,
- 108 — Constraint propagation sequence decision function,
- 109 — Procedure guide function,
- 110 — Conflict dissolution function,
- 111 — Constraint relaxation function,
- 112 — Design actuation activation section,
- 113 — Partial constraint propagation function,
- 114 — Candidate solution generation function,
- 115 — Conflict detection function,
- 116 — The setting situation and design situation of a value,
- 117 — Design procedure,
- 118 — Storing of a value,
- 119 — Workstation,
- 120 — Operating engineer,
- 121 — Model change function,
- 122 — Question generation function.

[Translation done.]

* NOTICES *

JPO and NCIP are not responsible for any damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.

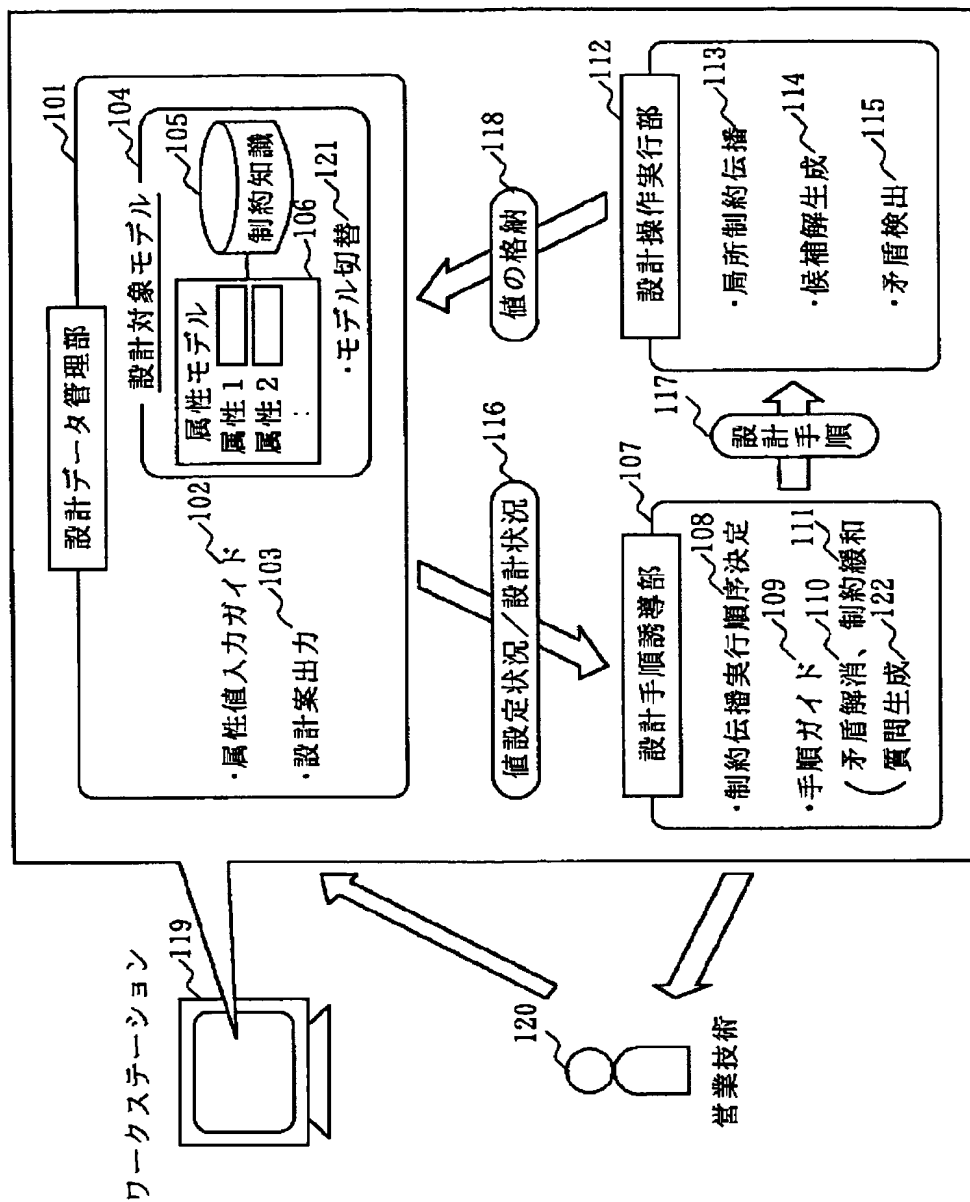
2.**** shows the word which can not be translated.

3.In the drawings, any words are not translated.

DRAWINGS

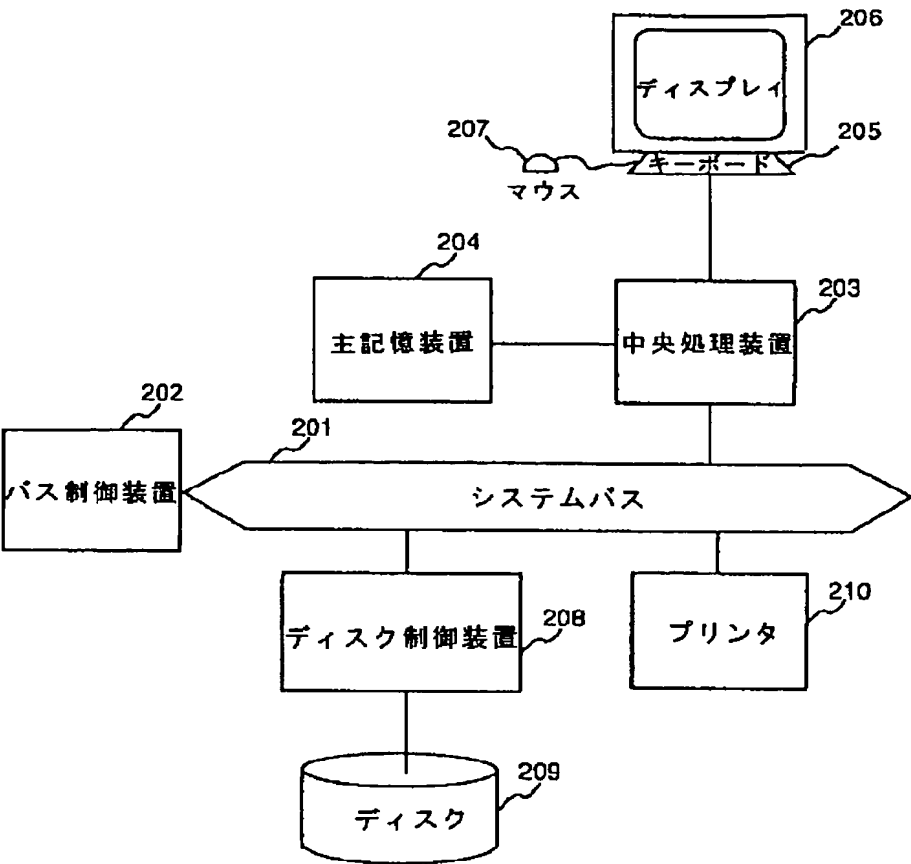
[Drawing 1]

図 1

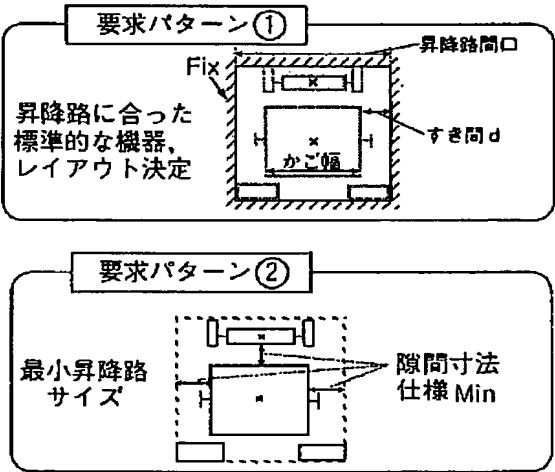


[Drawing 2]

図 2



[Drawing 15]
図 15



[Drawing 18]

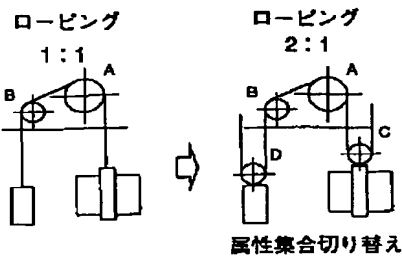
図 18

制約起動条件管理テーブル

制約コード	関連属性名称	形態	重要度
C 1	P1 P3 P4	テーブル	
C 2	P6 P5 P3	等式	
C 3	P6 P7	等式	
C 4	P6 P7	不等式	
C 5	P2 P7	テーブル	

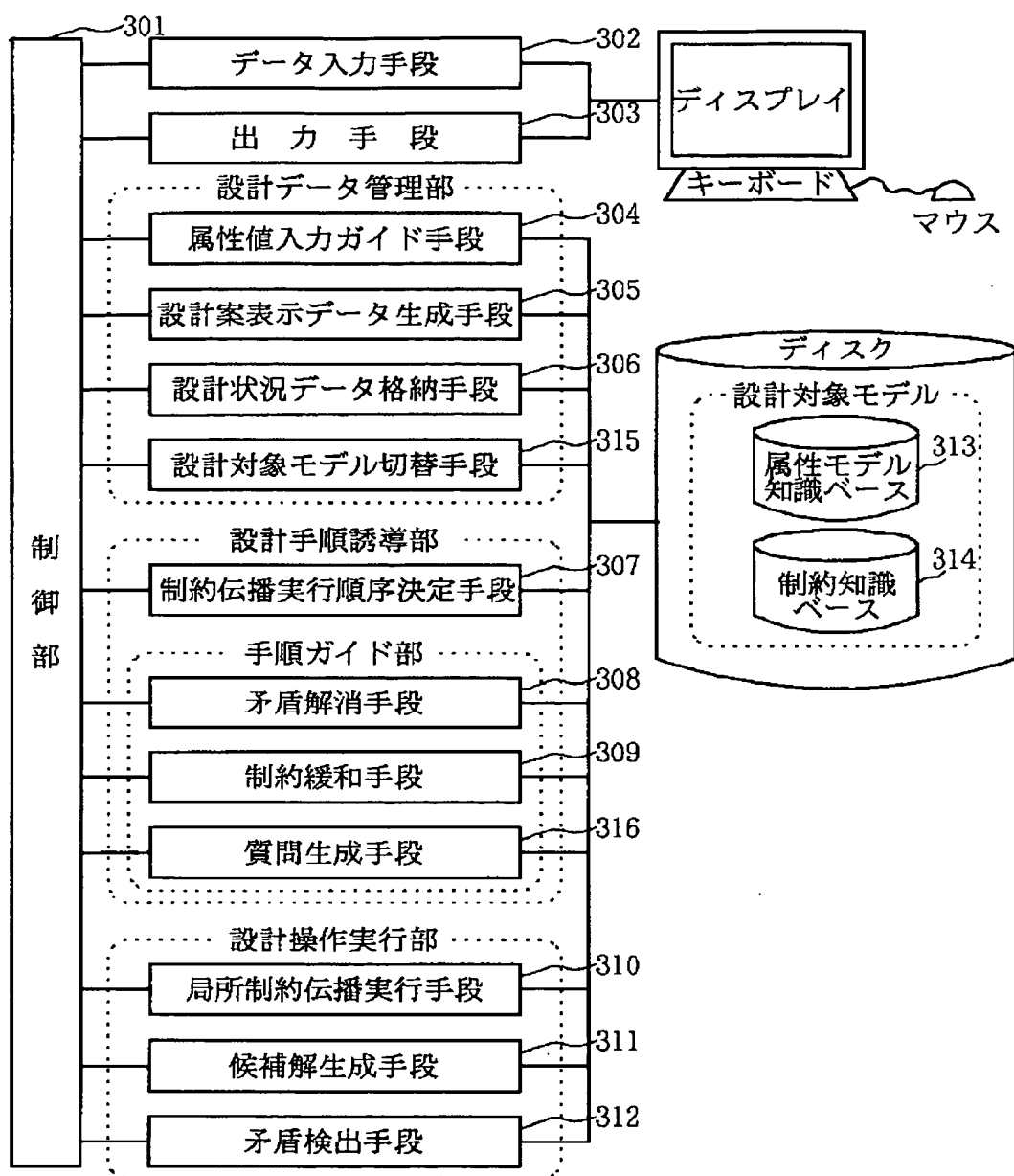
[Drawing 39]

図 39



[Drawing 3]

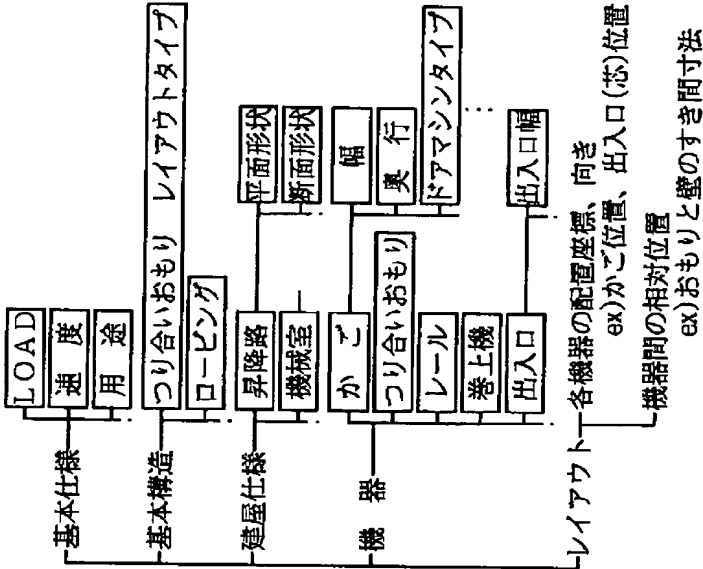
図 3



[Drawing 4]

図 4

属性



[Drawing 5]

制約

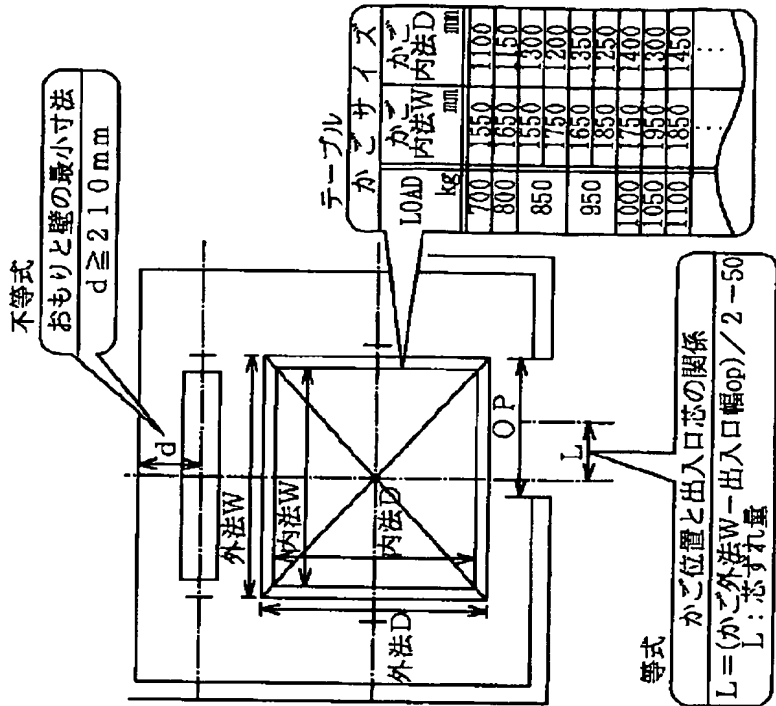
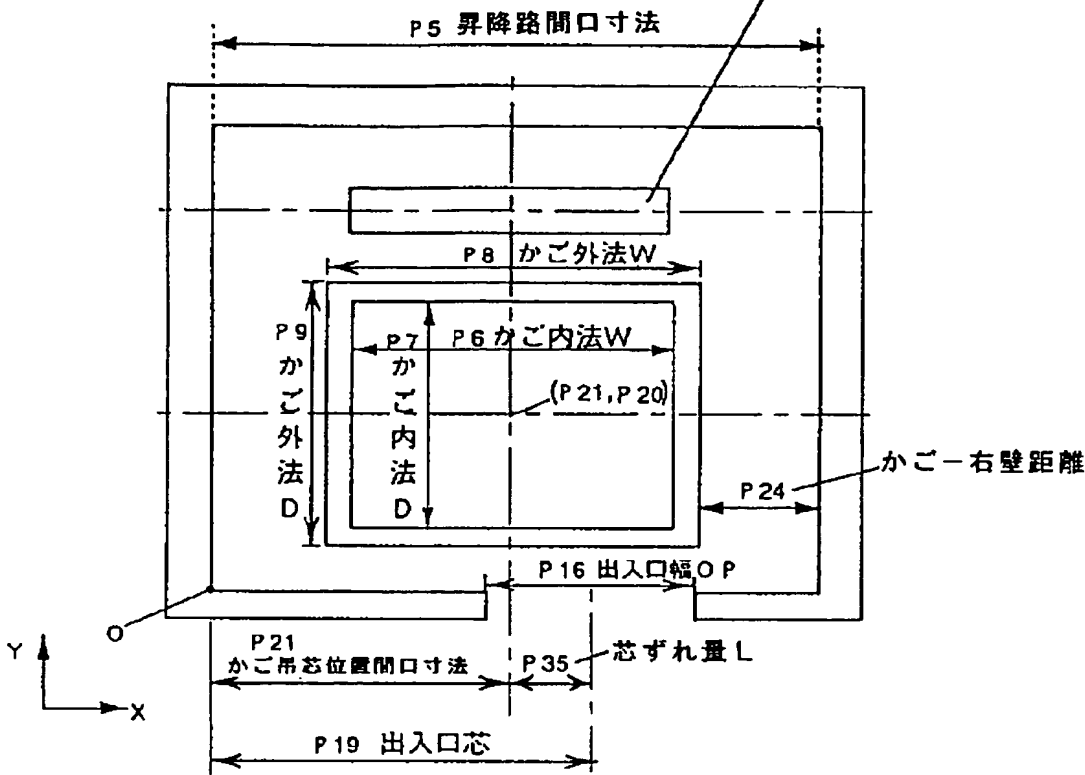


図 5

P 3 4
おもりレイアウトタイプ：後落ち



[Drawing 16]

属性コード	属性名	値 域	値	ロック/アンロック設定	設定状態	重み
P 1	LOAD	{700, 800, 850, 950, ...}		アンロック	未設定	
P 2	SPEED	160 以下		アンロック	未設定	
P 3	かが幅	{1550, 1650, 1750, ...}		アンロック	未設定	
P 4	かが奥行	{1100, 1150, 1200, ...}		アンロック	未設定	
P 5	昇降路間口寸法			アンロック	未設定	
P 6	すき間 d			アンロック	未設定	
P 7	すき間 d 最小寸法			アンロック	未設定	

図 16

[Drawing 49]

図 49

制約名称	値確定に必要な変数	値が確定された変数
307	A, B	C

[Drawing 6]

図 6

属性コード	属性名	値 域	値	ロック/アンロック	設定状態
:	:	:			
P 2	LOAD	{700, 800, 850, 950, ...}	850	アンロック	新規設定済
P 3	SPEED	160以下	150	アンロック	新規設定済
:	:	:			
P 5	昇降路開口寸法		3010	アンロック	新規設定済
P 6	かご内法W	{1550, 1650, 1750, ...}		アンロック	未 設 定
P 7	かご内法D	{1100, 1150, 1200, ...}		アンロック	未 設 定
P 8	かご外法W			アンロック	未 設 定
P 9	かご外法D			アンロック	未 設 定
P 10	非常止め仕様	{有, 無}	有	アンロック	新規設定済
:	:	:			
P 16	出入口幅OP		850	ロック	新規設定済
:	:	:			
P 19	出入口芯		2300	アンロック	新規設定済
:	:	:			
P 21	かご芯位置開口寸法			アンロック	未 設 定
:	:	:			
P 24	かご右壁距離			アンロック	未 設 定
:	:	:			
P 27	かご右壁距離最小寸法			アンロック	未 設 定
:	:	:			
P 34	おもりレイトタイプ	{後落, 右落, 左落}	後落	アンロック	新規設定済
P 35	芯ずれ量L			アンロック	未 設 定
:	:	:			

[Drawing 20]

図 20

要求パタン コード	制 約 重 要 度					属 性 重 要 度						
	C 1	C 2	C 3	C 4	C 5	P 1	P 2	P 3	P 4	P 5	P 6	P 7
1	0.8	0.6	0.3	0.4	0.6	0.9	0.9	0.8	0.8	0.9	0.3	0.4
2	0.8	0.6	0.9	0.3	0.9	0.9	0.9	0.8	0.8	0.3	0.9	0.9

[Drawing 7]

図 7

制約実体

P 2 LOAD	P 6 かご内法W	P 7 かご内法D
700	1550	1100
800	1650	1150
850	1550	1300
850	1750	1200
950	1650	1350
950	1850	1250
1000	1750	1400
1050	1950	1300
1100	1850	1450

かごサイズの決定

最小寸法の決定

P 10 非常止め仕様	P 3 SPEED	---	P 27 かごー右壁距離最小寸法	---
有	110以下	---	210	---
	110以上160以下	---	220	---
無	110以下	---	230	---
	110以上160以下	---	240	---

$$\text{C 5} \quad \boxed{\text{P 8}} \quad \text{かご外法W} = \boxed{\text{P 6}} \quad \text{かご内法W} + 50$$

かご外法Wの算出

$$\text{C 6} \quad \boxed{\text{P 9}} \quad \text{かご外法D} = \boxed{\text{P 7}} \quad \text{かご内法D} + 200$$

かご外法Dの算出

出入口芯とかご吊芯の位置関係

$$\text{C 1 2} \quad \boxed{\text{P 2 1}} \quad \text{かご吊芯位置間口寸法} = \boxed{\text{P 1 9}} \quad \text{出入口芯} - \boxed{\text{P 3 5}} \quad \text{芯ずれ量L}$$

かごー右壁距離の算出

$$\text{C 1 3} \quad \boxed{\text{P 2 7}} \quad \text{かごー右壁距離} = \boxed{\text{P 5}} \quad \text{昇降路間口寸法} - \boxed{\text{P 2 1}} \quad \text{かご吊芯位置間口寸法} - \frac{1}{2} \boxed{\text{P 8}} \quad \text{かご外法W}$$

$$\text{C 1 7} \quad \boxed{\text{P 3 5}} \quad \text{芯ずれ量L} = \frac{1}{2} \left(\boxed{\text{P 8}} \quad \text{かご外法W} - \boxed{\text{P 1 6}} \quad \text{出入口幅OP} \right) - 50$$

芯ずれ量の算出

かごー右壁距離の最小寸法チェック

$$\text{C C 1} \quad \boxed{\text{P 2 4}} \quad \text{かごー右壁距離} \geq \boxed{\text{P 2 7}} \quad \text{かごー右壁距離最小寸法}$$

[Drawing 50]

図 50

制約切り替えの条件だった変数	内容が切り替わった制約
X	307

[Drawing 8]

図 8

制約起動条件管理テーブル

コード	関連属性				形態
C 1	P 2	P 6	P 7		テ ー ブ ル
⋮					
C 4	P 3	P 10	P 27		テ ー ブ ル
C 5	P 7	P 9			等 式
C 6	P 6	P 8			等 式
⋮					
C 1 2	P 19	P 21	P 35		等 式
⋮					
C 1 3	P 5	P 8	P 21	P 24	等 式
⋮					
C 1 7	P 8	P 16	P 35		等 式
⋮					
CC 1	P 24	P 27			不 等 式
⋮					

[Drawing 24]

図 24

対話形設計支援装置

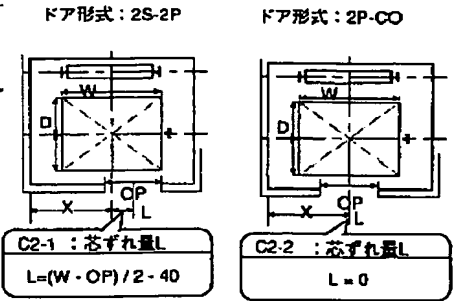
新規/変更? 1: 新規物件 2: 登録済物件

==> _____

24-1

[Drawing 40]

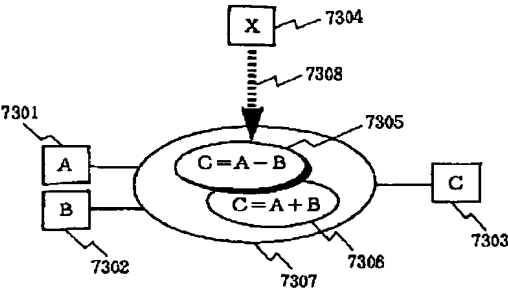
図 40



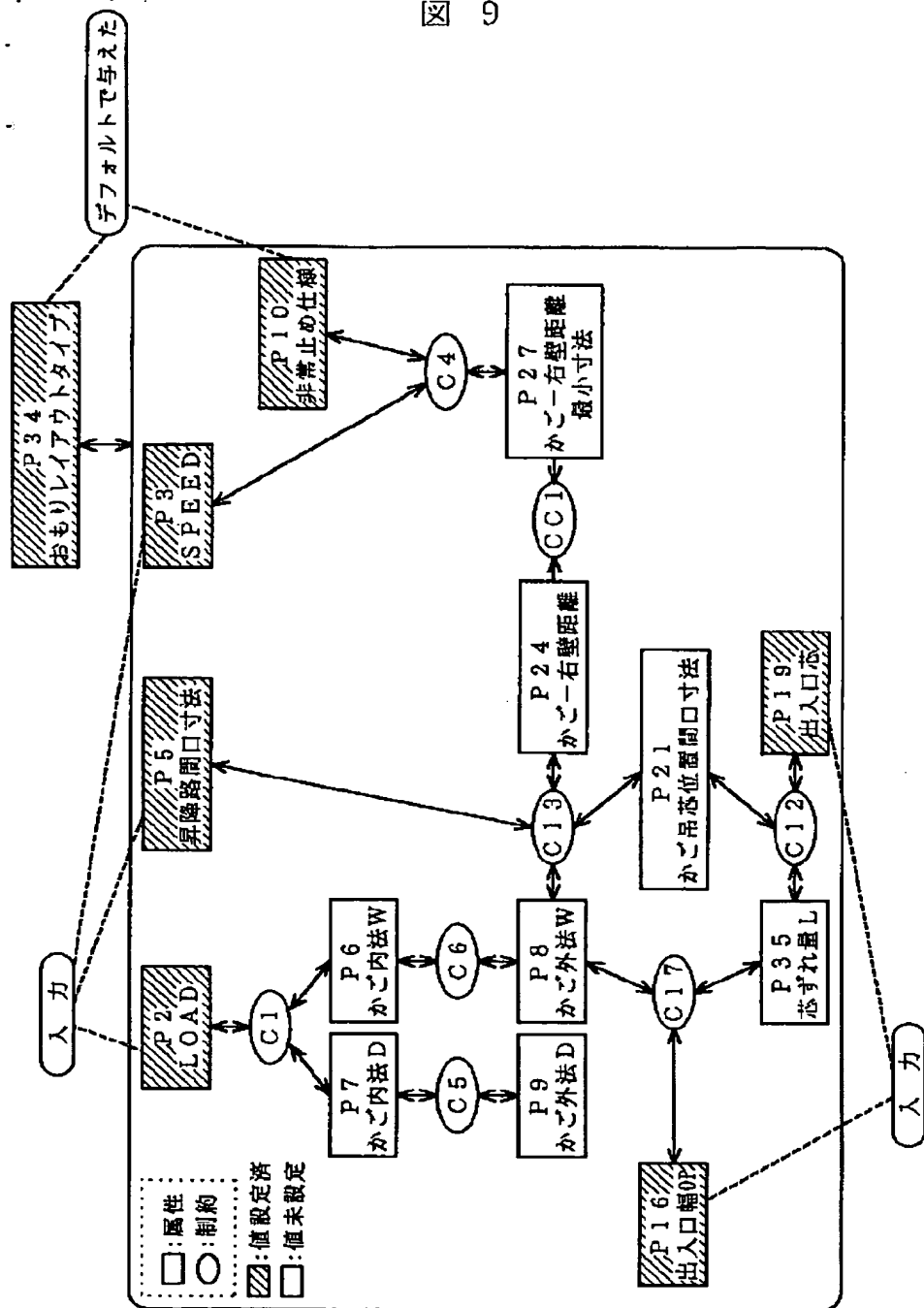
制約集合切り替え

[Drawing 48]

図 48

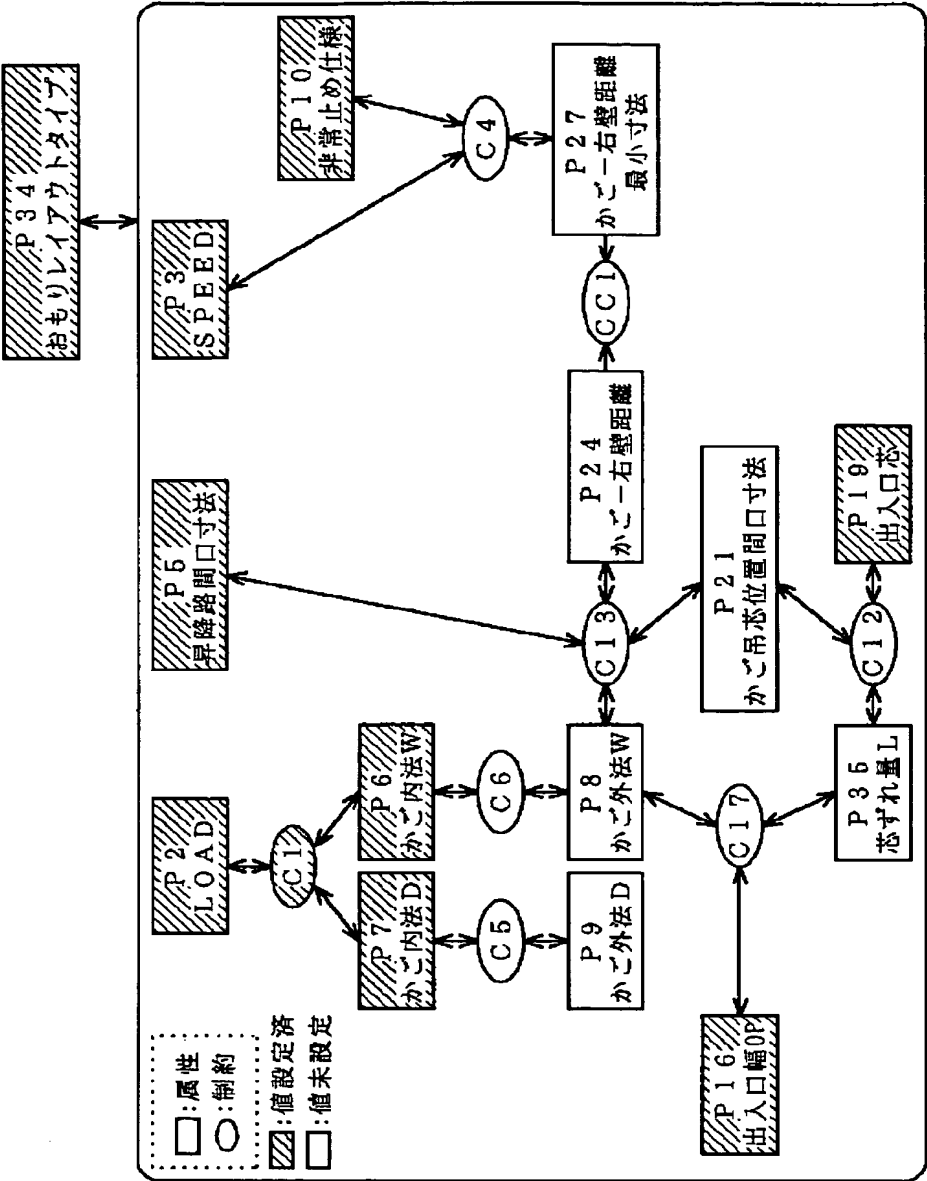


[Drawing 9]



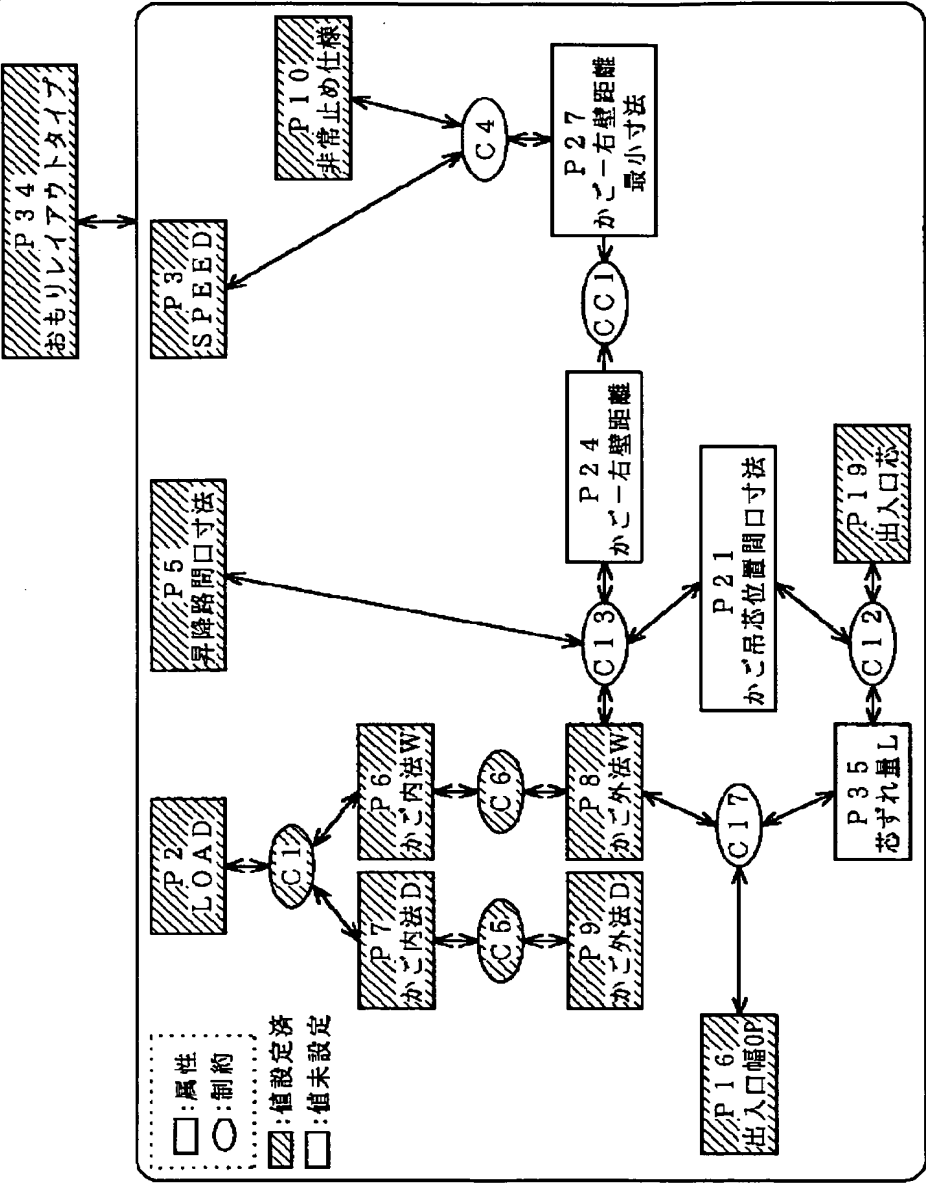
[Drawing 10]

図 10



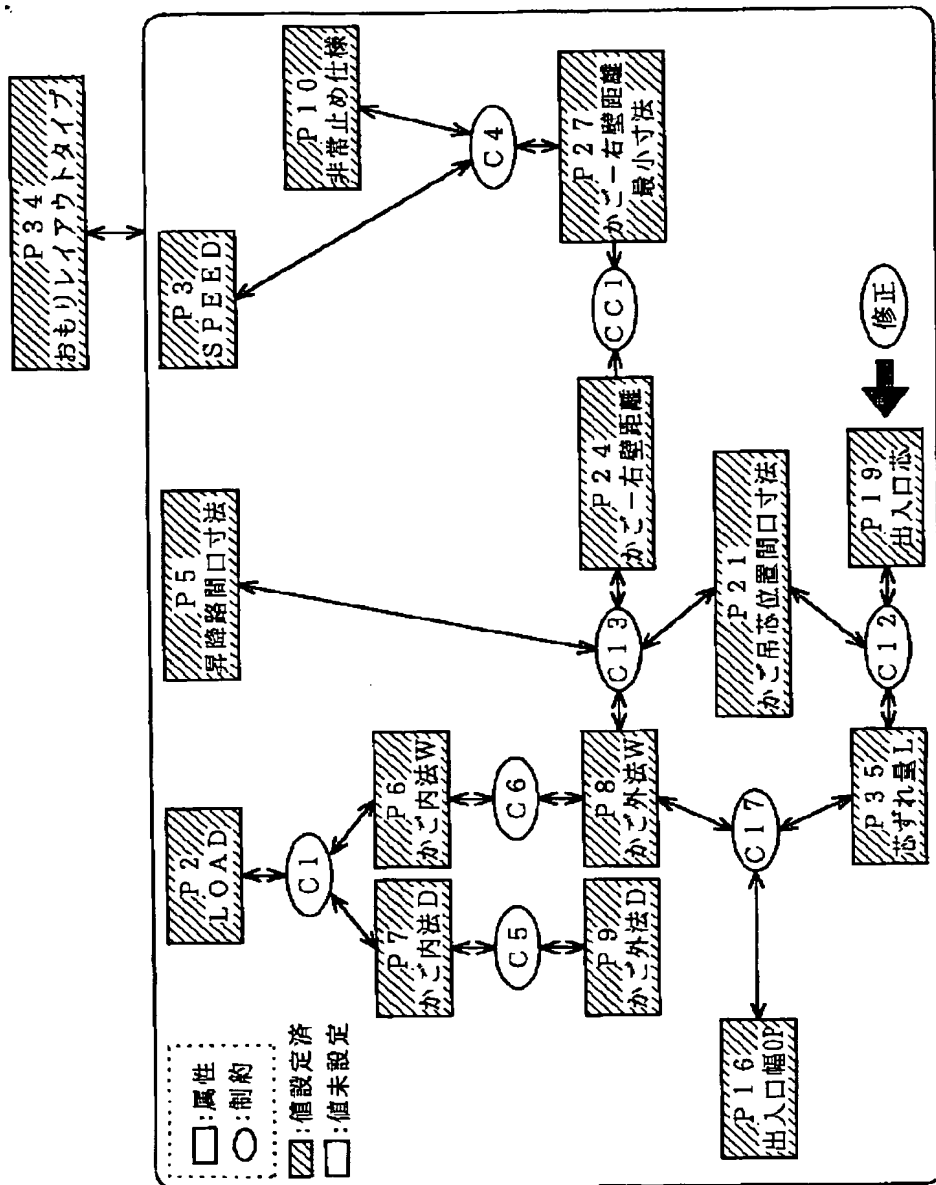
[Drawing 11]

図 11



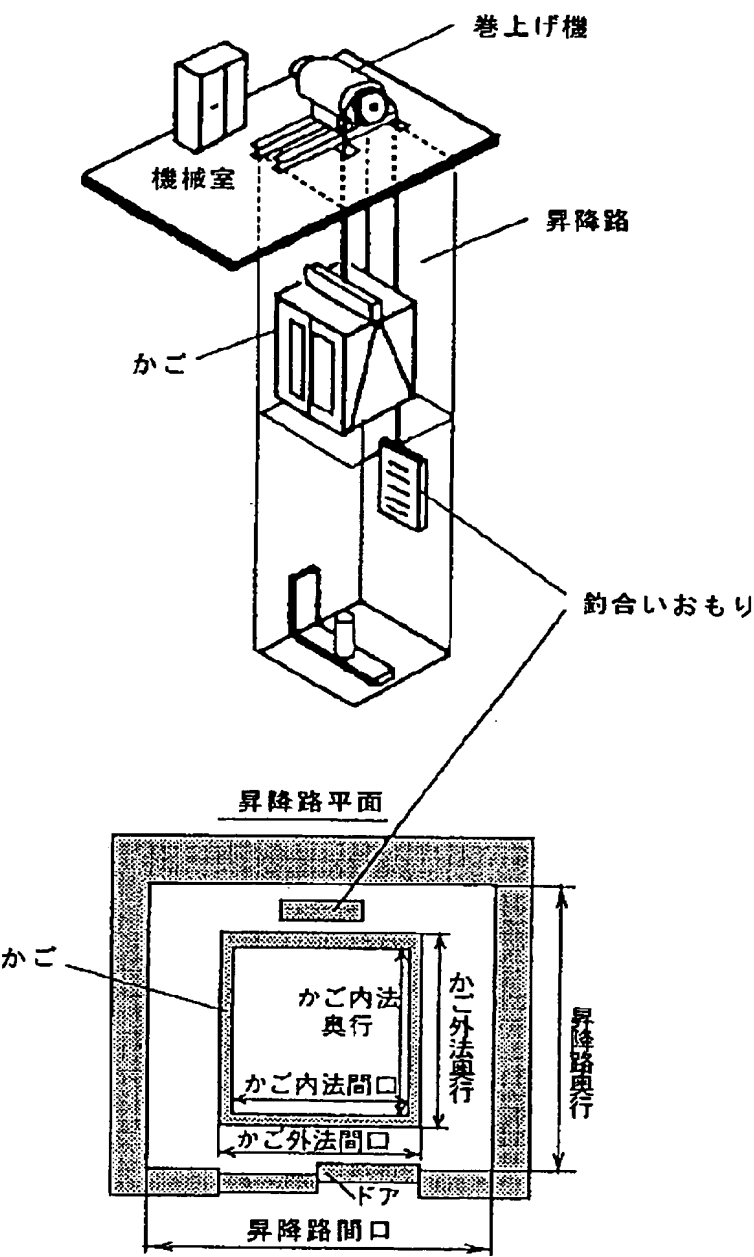
[Drawing 12]

図 12



[Drawing 13]

図 13



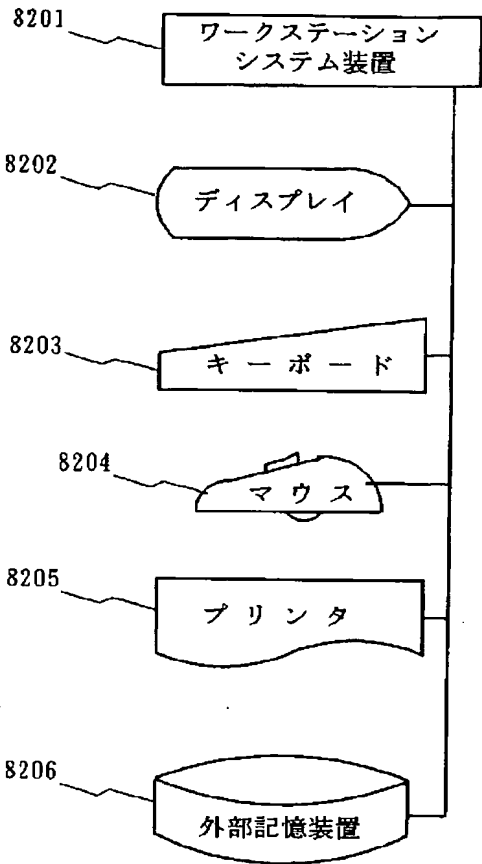
[Drawing 53]

図 53

制約切り替えに必要な変数	内容が切り替わった制約
P 6	C 4

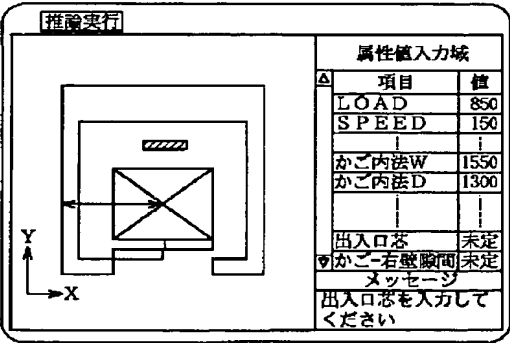
[Drawing 55]

図 55



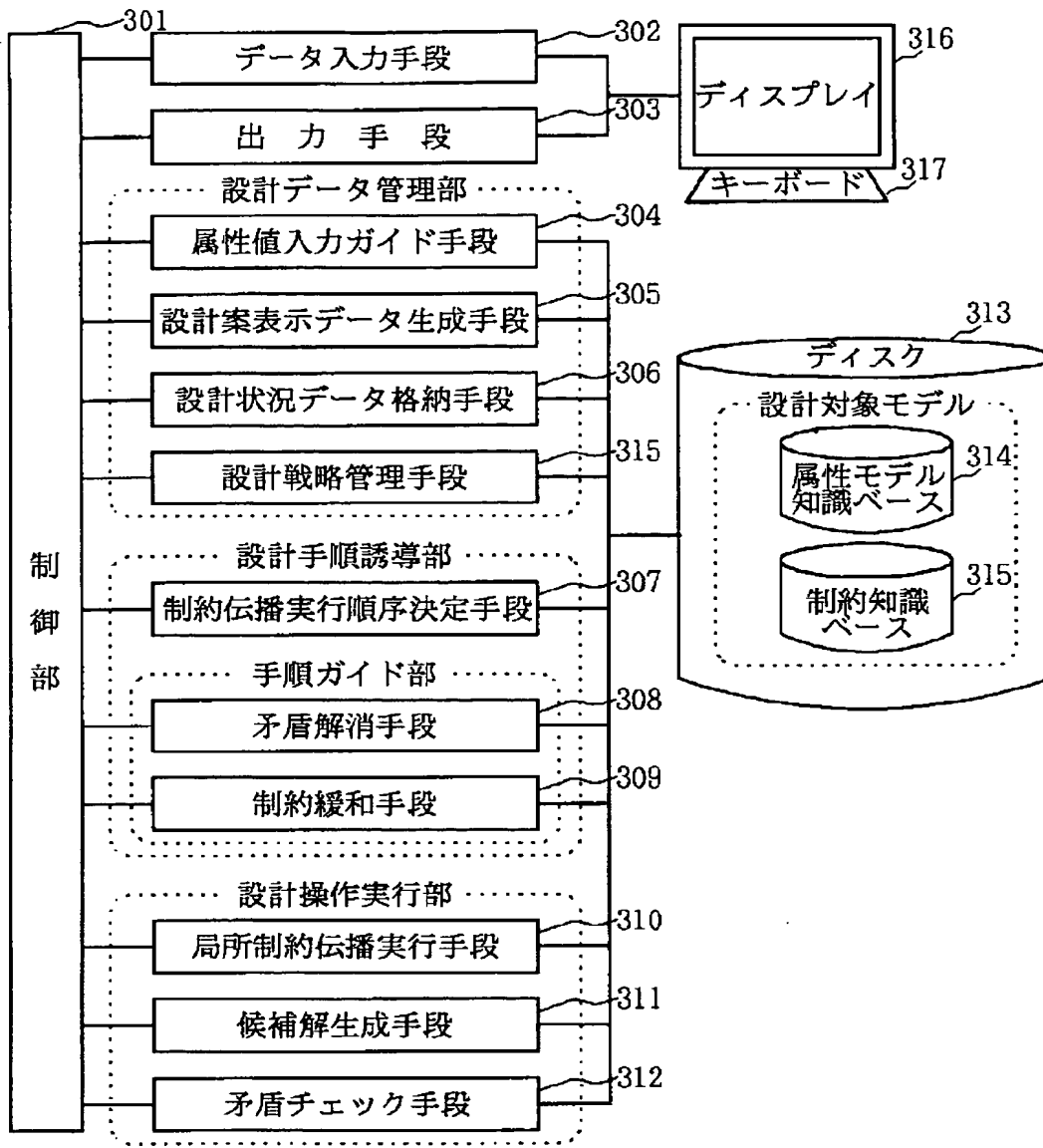
[Drawing 59]

図 59



[Drawing 14]

図 14



[Drawing 17]

図 17

C 1

P 1 LOAD	P 1 かご幅	P 1 かご奥行
7 0 0	1 5 5 0	1 1 0 0
8 0 0	1 6 5 0	1 1 5 0
8 5 0	1 5 5 0	1 3 0 0
8 5 0	1 7 5 0	1 2 0 0
9 5 0	1 6 5 0	1 3 5 0
9 5 0	1 8 5 0	1 2 5 0
1 0 0 0	1 7 5 0	1 4 0 0
1 0 5 0	1 9 5 0	1 3 0 0
1 1 0 0	1 8 5 0	1 4 5 0

C 2

$$\boxed{\begin{matrix} P 6 \\ \text{すき間 } d \end{matrix}} = \frac{1}{2} \left(\boxed{\begin{matrix} P 5 \\ \text{昇降路開口寸法} \end{matrix}} - \boxed{\begin{matrix} P 3 \\ \text{かご幅} \end{matrix}} \right)$$

C 3

$$\boxed{\begin{matrix} P 6 \\ \text{すき間 } d \end{matrix}} = \boxed{\begin{matrix} P 7 \\ \text{すき間 } d \text{ 最小寸法} \end{matrix}}$$

C 4

$$\boxed{\begin{matrix} P 6 \\ \text{すき間 } d \end{matrix}} \geq \boxed{\begin{matrix} P 7 \\ \text{すき間 } d \text{ 最小寸法} \end{matrix}}$$

C 5

P 2 S P E E D	...	P 7 すき間 d 最小寸法	...
110以下	...	210	...
110以上160以下	...	220	...
110以下	...	230	
110以上160以下	...	240	

[Drawing 19]

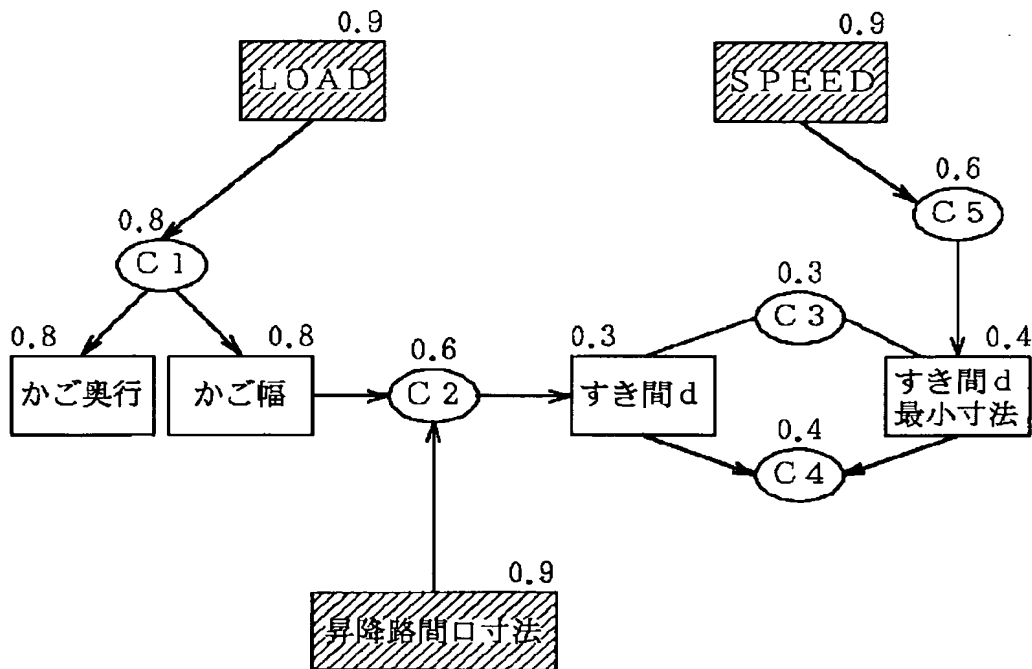
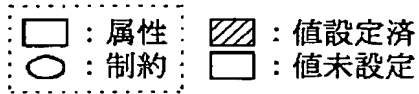
図 19

制 約 実 体

制約コード	実 体																														
C 1	<table><tr><th>P 1 LOAD</th><th>P 1 かご幅</th><th>P 1 かご奥行</th></tr><tr><td>7 0 0</td><td>1 5 5 0</td><td>1 1 0 0</td></tr><tr><td>8 0 0</td><td>1 6 5 0</td><td>1 1 5 0</td></tr><tr><td>8 5 0</td><td>1 5 5 0</td><td>1 3 0 0</td></tr><tr><td>8 5 0</td><td>1 7 5 0</td><td>1 2 0 0</td></tr><tr><td>9 5 0</td><td>1 6 5 0</td><td>1 3 5 0</td></tr><tr><td>9 5 0</td><td>1 8 5 0</td><td>1 2 5 0</td></tr><tr><td>1 0 0 0</td><td>1 7 5 0</td><td>1 4 0 0</td></tr><tr><td>1 0 5 0</td><td>1 9 5 0</td><td>1 3 0 0</td></tr><tr><td>1 1 0 0</td><td>1 8 5 0</td><td>1 4 5 0</td></tr></table>	P 1 LOAD	P 1 かご幅	P 1 かご奥行	7 0 0	1 5 5 0	1 1 0 0	8 0 0	1 6 5 0	1 1 5 0	8 5 0	1 5 5 0	1 3 0 0	8 5 0	1 7 5 0	1 2 0 0	9 5 0	1 6 5 0	1 3 5 0	9 5 0	1 8 5 0	1 2 5 0	1 0 0 0	1 7 5 0	1 4 0 0	1 0 5 0	1 9 5 0	1 3 0 0	1 1 0 0	1 8 5 0	1 4 5 0
P 1 LOAD	P 1 かご幅	P 1 かご奥行																													
7 0 0	1 5 5 0	1 1 0 0																													
8 0 0	1 6 5 0	1 1 5 0																													
8 5 0	1 5 5 0	1 3 0 0																													
8 5 0	1 7 5 0	1 2 0 0																													
9 5 0	1 6 5 0	1 3 5 0																													
9 5 0	1 8 5 0	1 2 5 0																													
1 0 0 0	1 7 5 0	1 4 0 0																													
1 0 5 0	1 9 5 0	1 3 0 0																													
1 1 0 0	1 8 5 0	1 4 5 0																													
C 2	$\boxed{\begin{array}{c} P 6 \\ \text{すき間 } d \end{array}} = \frac{1}{2} \left(\boxed{\begin{array}{c} P 5 \\ \text{昇降路開口法} \end{array}} - \boxed{\begin{array}{c} P 3 \\ \text{かご幅} \end{array}} \right)$																														
C 3	$\boxed{\begin{array}{c} P 6 \\ \text{すき間 } d \end{array}} = \boxed{\begin{array}{c} P 7 \\ \text{すき間 } d \text{ 最小寸法} \end{array}}$																														
C 4	$\boxed{\begin{array}{c} P 6 \\ \text{すき間 } d \end{array}} \geq \boxed{\begin{array}{c} P 7 \\ \text{すき間 } d \text{ 最小寸法} \end{array}}$																														
C 5	<table><tr><th>P 2 SPEED</th><th>...</th><th>P 7 すき間 d 最小寸法</th><th>...</th></tr><tr><td>110以下</td><td>...</td><td>210</td><td>...</td></tr><tr><td>110以上160以下</td><td>...</td><td>220</td><td>...</td></tr><tr><td>110以下</td><td>...</td><td>230</td><td></td></tr><tr><td>110以上160以下</td><td>...</td><td>240</td><td></td></tr></table>	P 2 SPEED	...	P 7 すき間 d 最小寸法	...	110以下	...	210	...	110以上160以下	...	220	...	110以下	...	230		110以上160以下	...	240											
P 2 SPEED	...	P 7 すき間 d 最小寸法	...																												
110以下	...	210	...																												
110以上160以下	...	220	...																												
110以下	...	230																													
110以上160以下	...	240																													

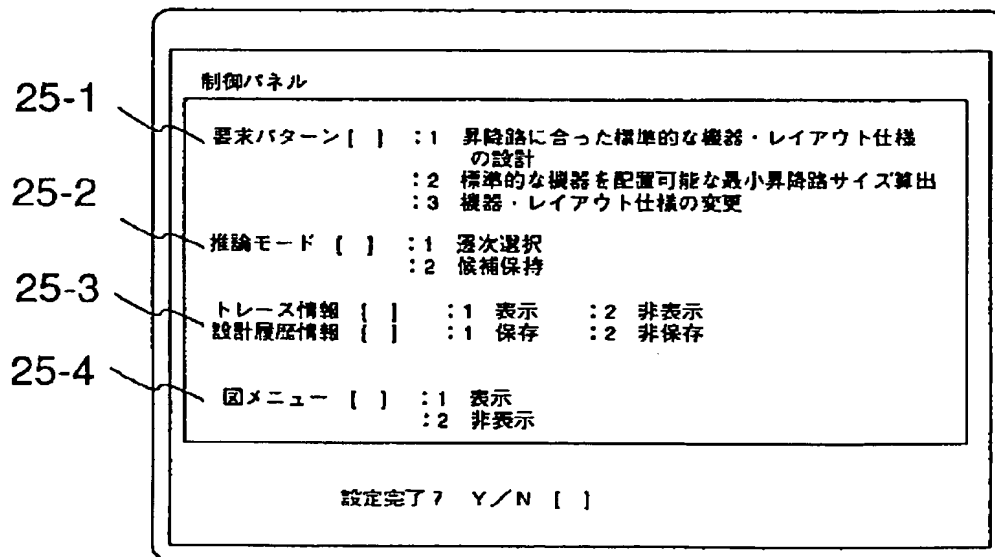
[Drawing 21]

図 21



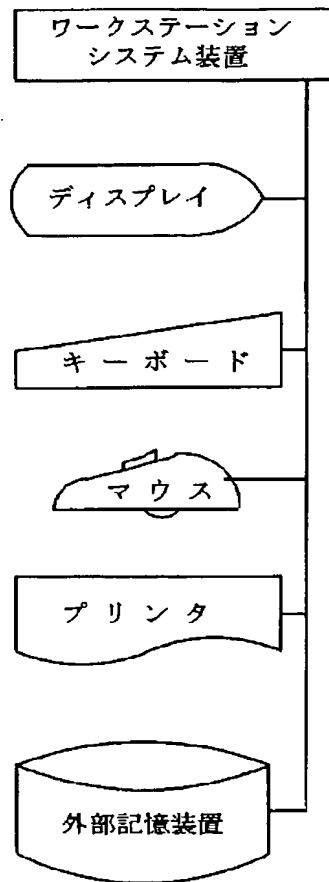
[Drawing 25]

図 25



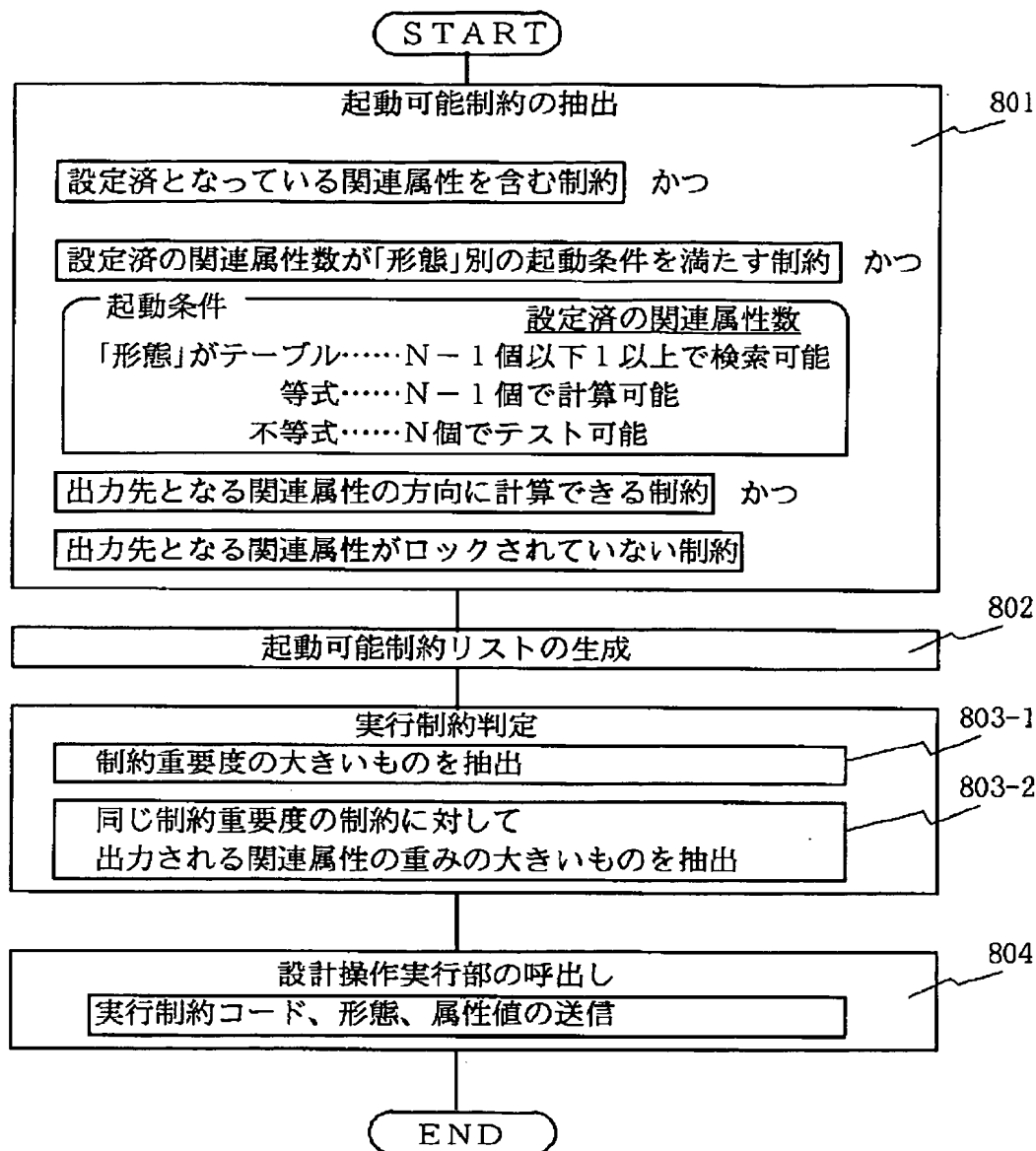
[Drawing 62]

図 62



[Drawing 22]

図 22



[Drawing 23]

图 26

確認実行	増減モード	検討値表示	計算立案	制約緩和	終了		
					属性値入力領域		
					△	CWTレイアウトタイプ	後落
						▽	
確認							
△	基本仕様						
	適用仕様						
	かご仕様	かご位置					
	CWT仕様	CWT位置					
	出入口仕様	出入口位置					
	車輪駆動方式						
▽							

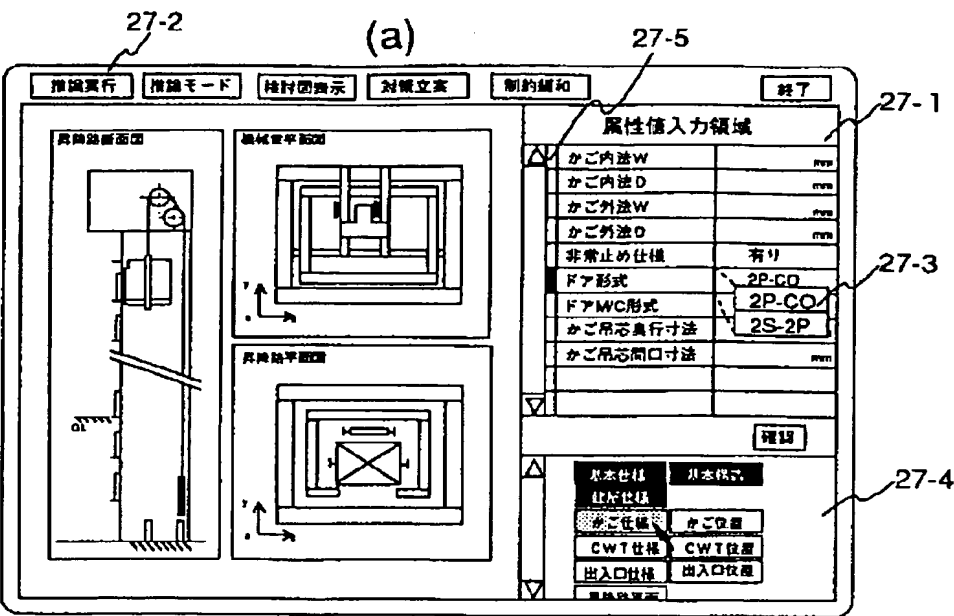


26-1

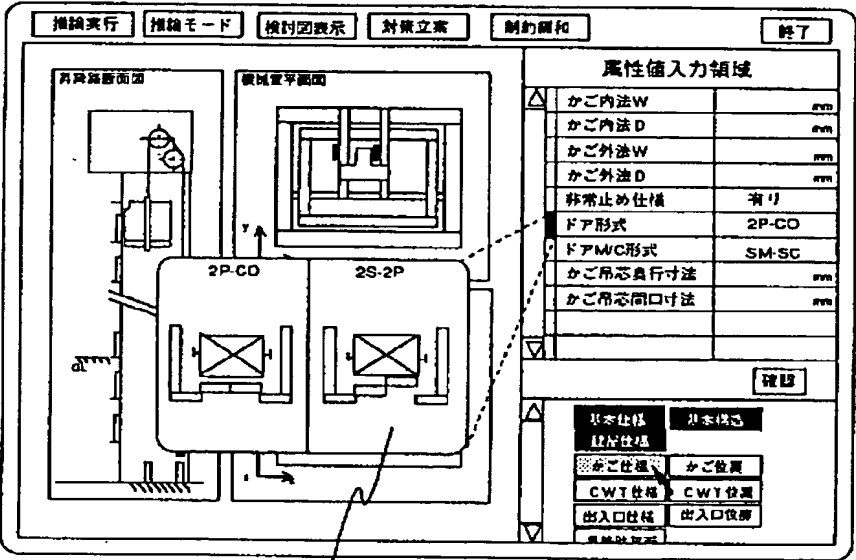
26-2

[Drawing 27]

図 27

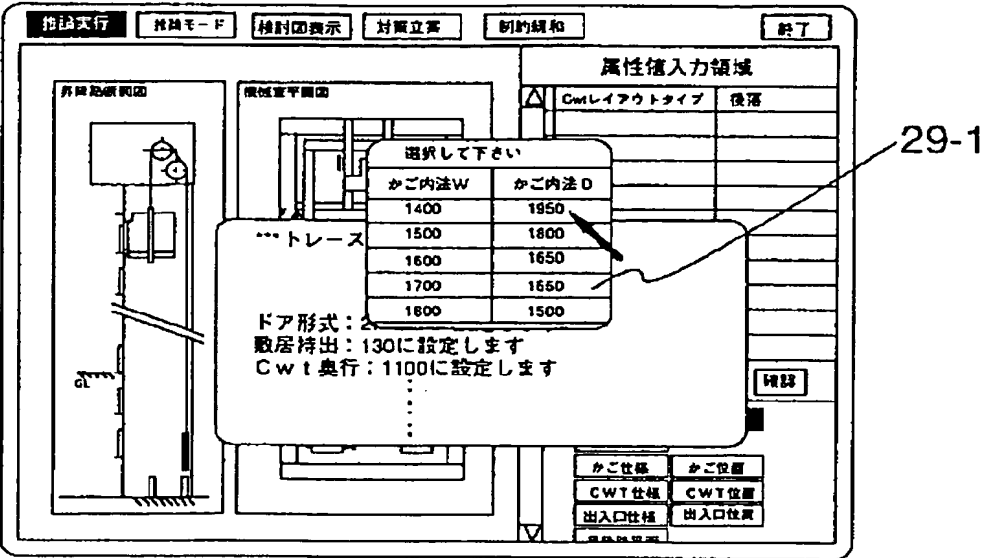


(b)



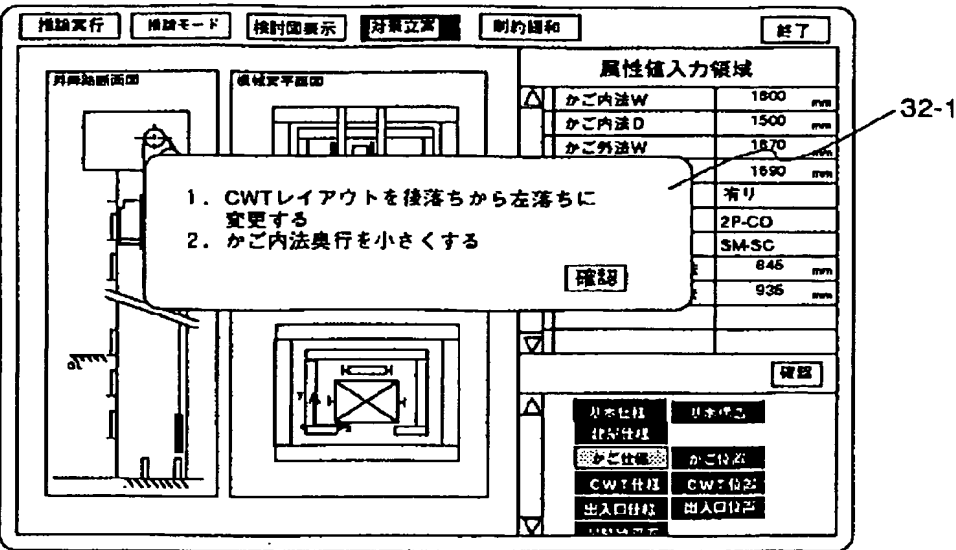
[Drawing 29]

図 29



[Drawing 32]

図 32



[Drawing 30]

図 30

制約実行

推論モード

検討図表示

対策立案

制約緩和

終了

昇降機断面図

機械室平面図

制約伝播失敗

入力属性に従って仕様を算出すると
制約"巻上機形式決定"
で矛盾が発生します

確認

属性値入力領域

かご内法W	1800 mm
かご内法D	1500 mm
かご外法W	1870 mm
かご外法D	1690 mm
非常止め仕様	有り
ドア形式	2P-CO
ドアM/C形式	SM-SC
かご吊芯奥行寸法	845 mm
かご吊芯間口寸法	935 mm

確認

基本仕様

基本設定

かご仕様

かご部品

CWT仕様

CWT設定

出入口仕様

出入口設定

制約実行

推論モード

検討図表示

対策立案

制約緩和

終了

昇降機断面図

機械室平面図

昇降機平面図

属性値入力領域

かご内法W	mm
かご内法D	mm
かご外法W	mm
かご外法D	mm
非常止め仕様	有り
ドア形式	2P-CO
ドアM/C形式	SM-SC
かご吊芯奥行寸法	mm
かご吊芯間口寸法	mm

確認

基本仕様

基本設定

かご仕様

かご部品

CWT仕様

CWT設定

出入口仕様

出入口設定

[Drawing 52]

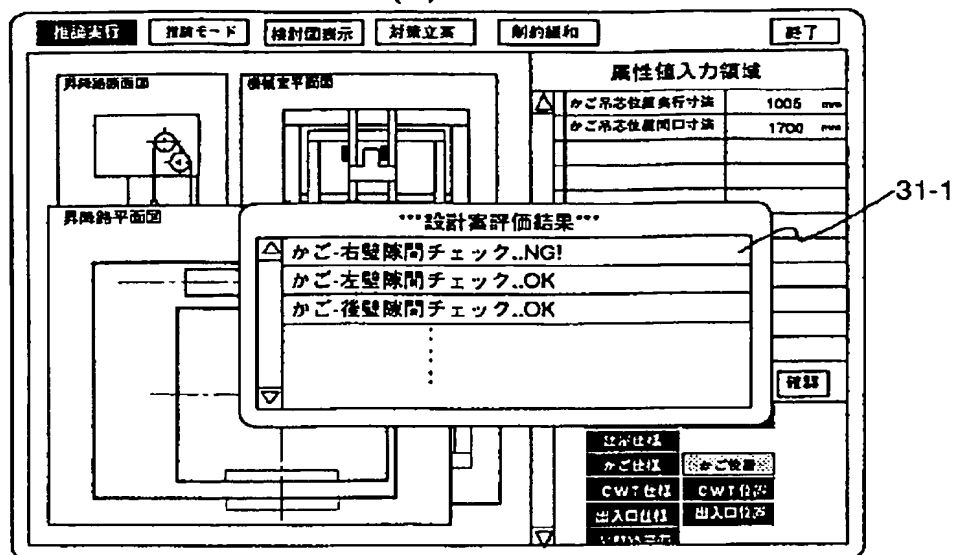
図 52

制約名称	値確定に必要な変数	値が確定された変数
C 1	P 1	P 4, P 5
C 2	P 2, P 3	P 6
C 3	P 5	P 8
C 4	P 5, P 7	P 9
C 5	P 9	P 1 0

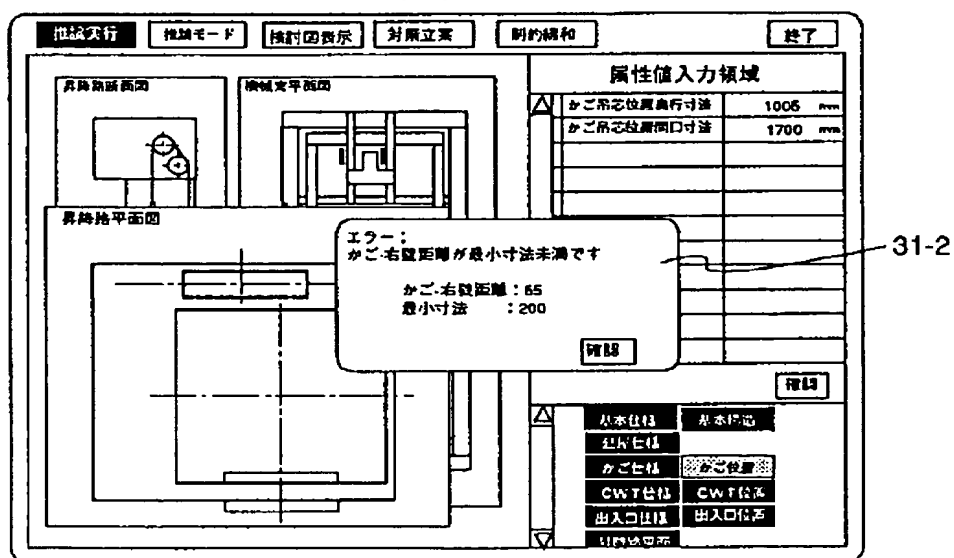
[Drawing 31]

図 31

(a)

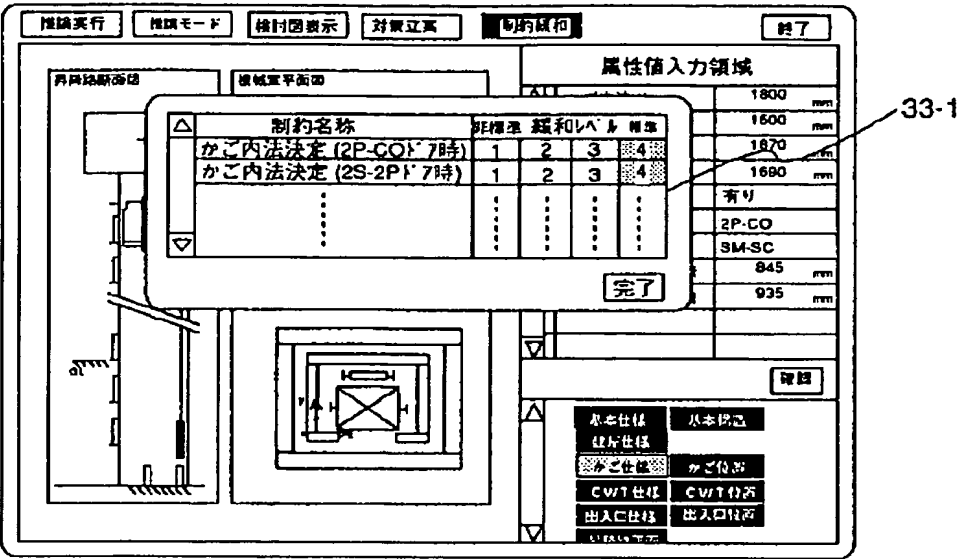


(b)



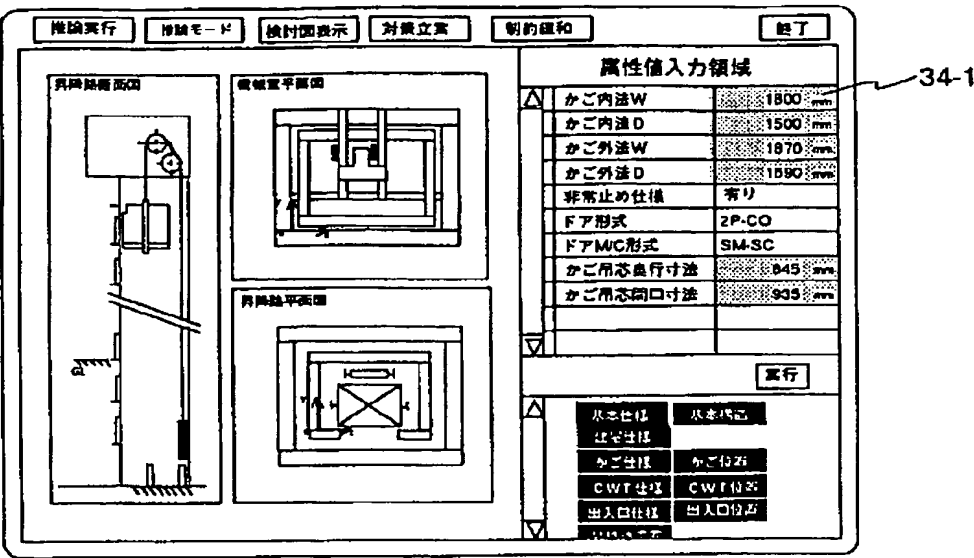
[Drawing 33]

図 33



[Drawing 35]

図 35



[Drawing 34]

図 34

推進実行

推測モード

検討図表示

対策立案

制約緩和

終了

昇降路断面図

昇降路平面図

昇降路平面図

属性値入力領域

かご内法W	1800	mm
かご内法D	1500	mm
かご外法W	1870	mm
かご外法D	1680	mm
非常止め仕置	有り	
ドア形式	2P-CO	
ドアMC形式	SM-SC	
かご吊芯奥行寸法	845	mm
かご吊芯間口寸法	935	mm

確認

基本仕様	基本構造
仕舞仕様	
かご仕様	かご吊り
CW仕様	CW吊り
出入口仕様	出入口吊り



推進実行

推測モード

検討図表示

対策立案

制約緩和

終了

昇降路断面図

昇降路平面図

昇降路平面図

属性値入力領域

かご内法W	1800	mm
かご内法D	1500	mm
かご外法W	1870	mm
かご外法D	1680	mm
非常止め仕置	有り	
ドア形式	2P-CO	
ドアMC形式	SM-SC	
かご吊芯奥行寸法	845	mm
かご吊芯間口寸法	935	mm

確認

基本仕様	基本構造
仕舞仕様	
かご仕様	かご吊り
CW仕様	CW吊り
出入口仕様	出入口吊り

設定可能な属性項目がありません。
属性”天井意匠”を入力して下さい。

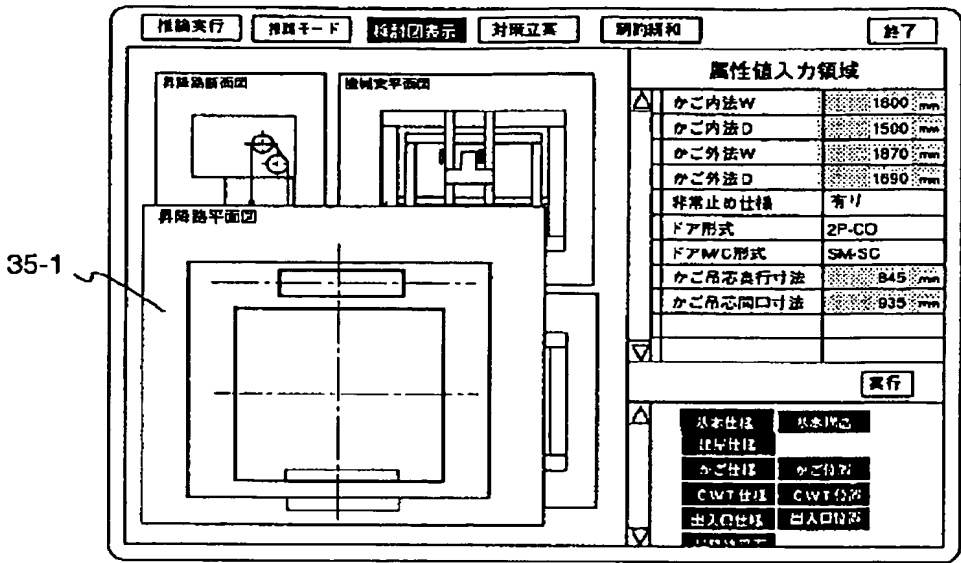
次候補

確認

33-1

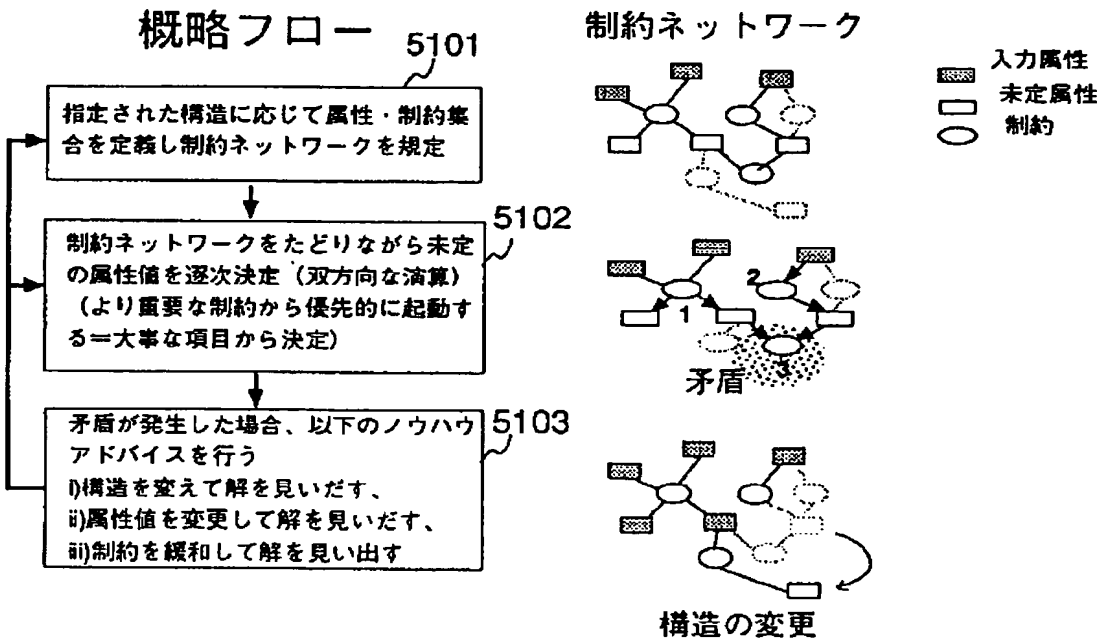
[Drawing 36]

図 36



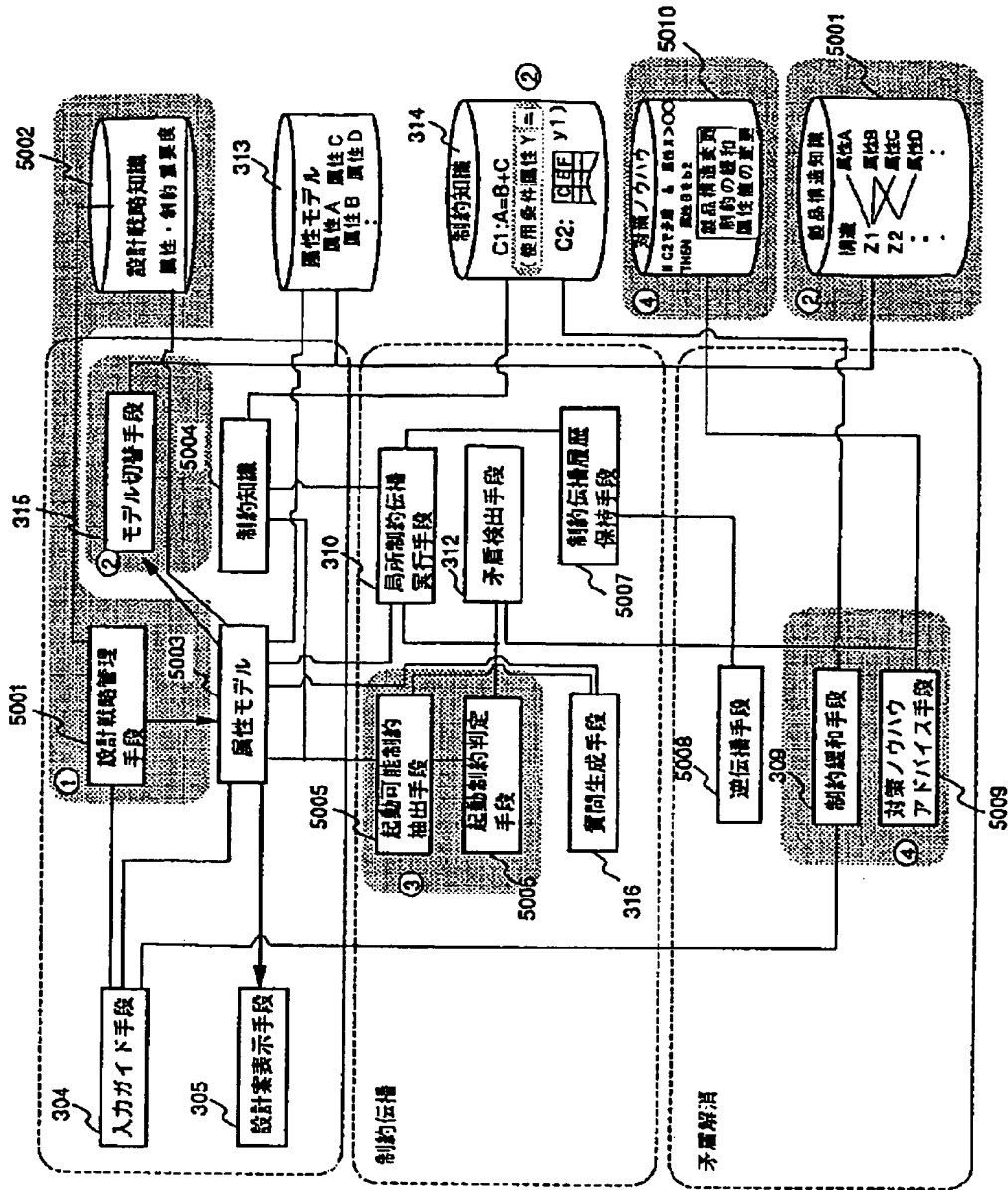
[Drawing 38]

図 38



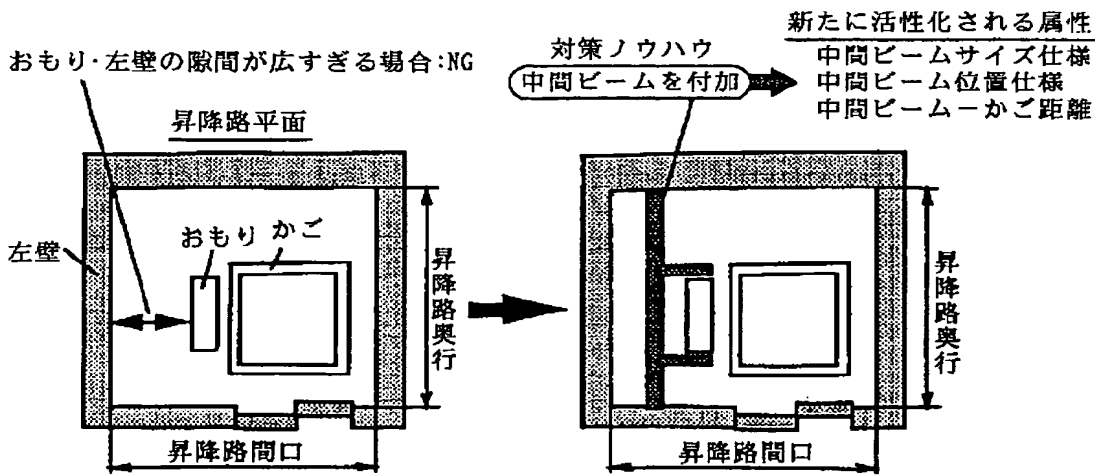
[Drawing 37]

図 37



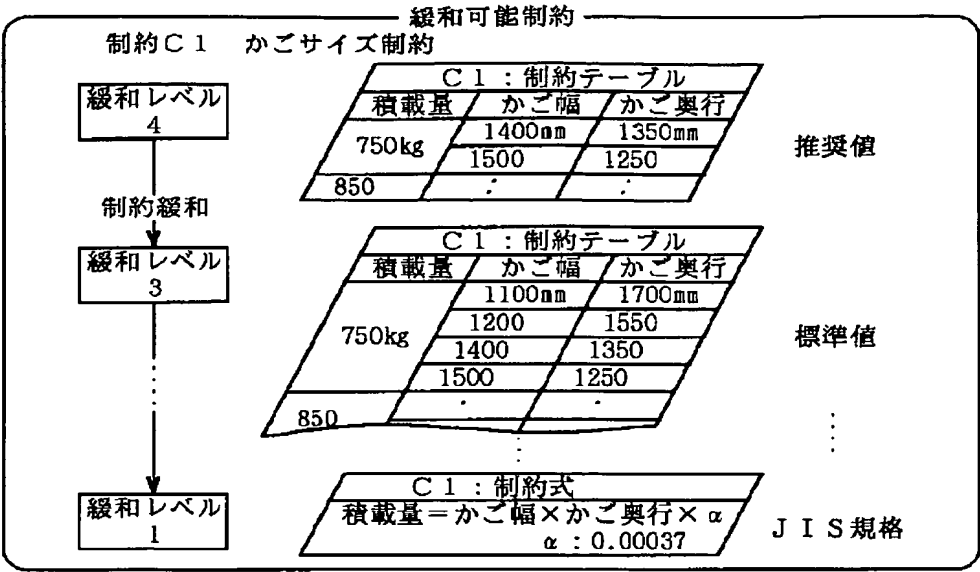
[Drawing 41]

図 41

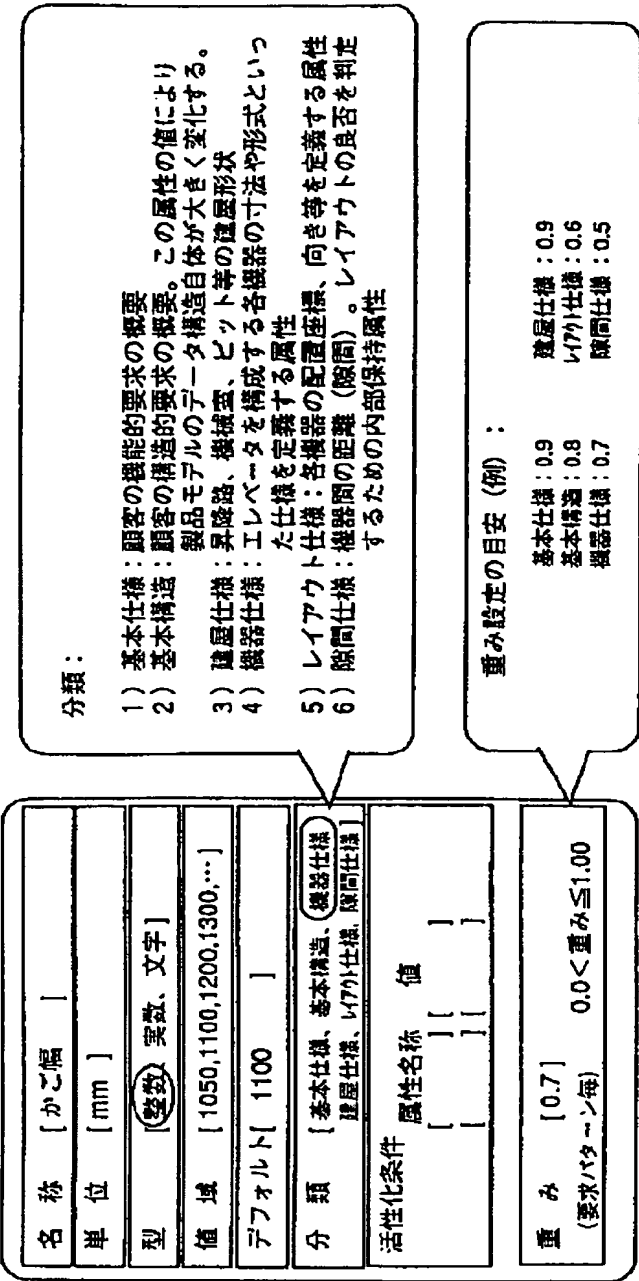


[Drawing 42]

図 42



[Drawing 43]



[Drawing 44]

図 44

制約名称【かごサイズ決定】C1

形態【(テーブル) 不等式入テーブル
等式 不等式 設計計算】

用途【(機器仕様選定) レイアウト決定
評価 デフォルト設定】

起動方向性【有り(無し)】
出力のみ属性【】【】【】...

活性化条件
属性名称 値
【ドア形式】【2P-CO】
【用途】【人荷用】

緩和可否【(可) 否】
緩和レベル数【4】

重要度【0.8】
(要求パターン毎) 0.0<重み≤1.00

制約実体情報

C1緩和レベル4

積載量	幅W _{mm}	奥行D _{mm}
600	1400	1100
	1500	1050
750	1400	1350
	1500	1250
		1450

⋮
緩和レベル3
⋮
緩和レベル2
⋮

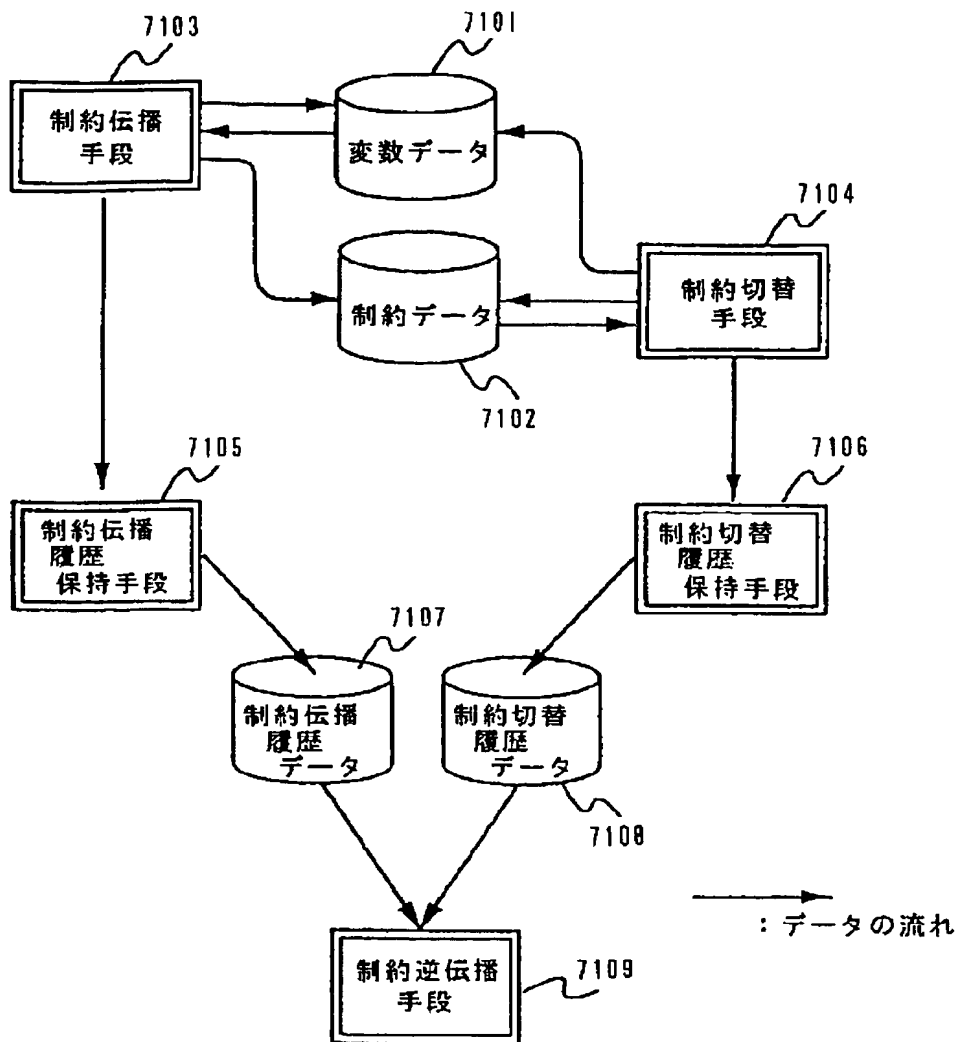
[Drawing 45]

図 45

形態	テーブル			テーブル (不等式入り)		等式		不等式		設計計算		
	A	B	C	A	B	A=B+CxD+...		A ≥ B		A,B,... [Diagram]		
	a1	b1	c1	a1<A≤a2	b1							
	a1	b1	c2	a2<A≤a3	b1							
	a1	b2	c3	a3<A≤a4	b2							
			c4		b3							
起動方向性			無/有		有		無/有		無		有	
用途別 起動形態	用途	起動形態	セツト	チェック	セツト	チェック	セツト	チェック	セツト	チェック	セツト	チェック
		機器仕様選定	○	○	○	○	○	○			○	○
		レイアウト										
		評価		○		○		○		○		○
		デフォルト 設定	○		○		○				○	

[Drawing 46]

図 46



[Drawing 58]

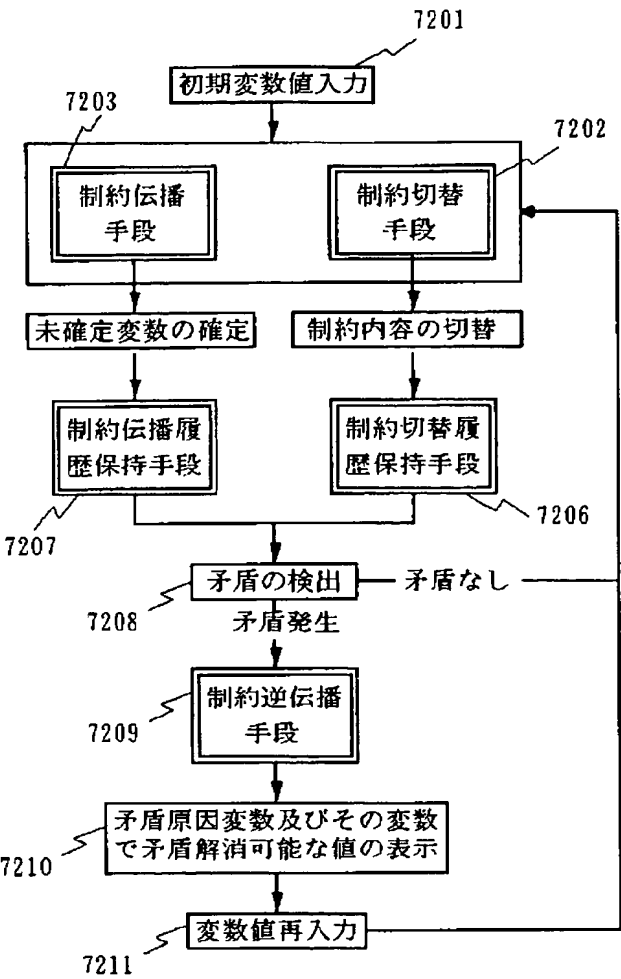
検索キー

配置パターン別	1	2	3	
ノットスケール 図形データ	<p>対応寸法 属性名: すきまA すきまB</p>	<p>対応寸法 属性名: すきまA すきまB</p>	<p>対応寸法 属性名: すきまA すきまB</p>	

図 58

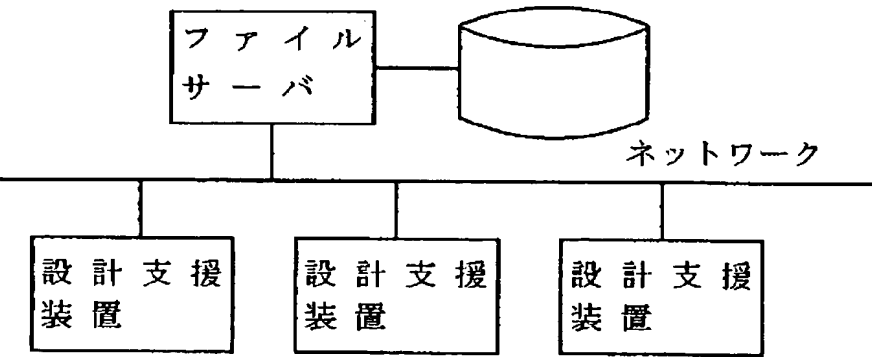
[Drawing 47]

図 47



[Drawing 60]

図 60



[Drawing 66]

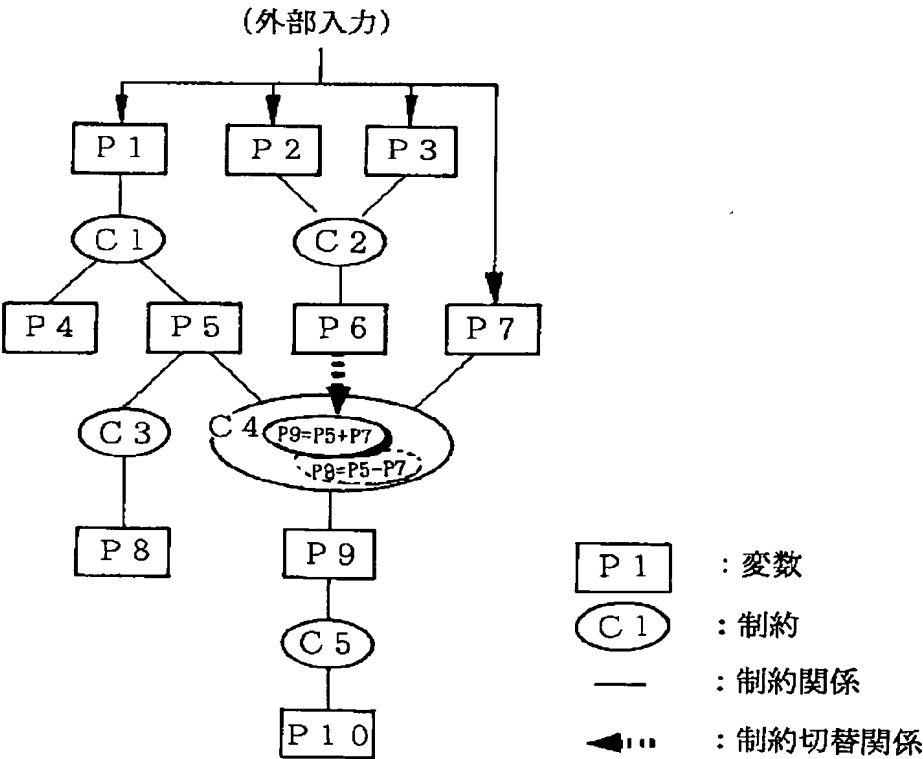
図 66

1450	950	1000	1050	1100	1150
1400	900	950	1000	1050	1100
1350	900	950	1000	1050	1100
1300	850	900	950	1000	1050
1250	800	850	900	950	1000
1200	750	800	850	900	950
1150	750	800	850	900	950
1100	700	750	800	850	900
1050 (mm)	積載荷重 700 (kg)	750	800	850	900
内径長 径寸法開口	1550 (mm)	1650	1750	1850	1950

標準制約 非標準制約

[Drawing 51]

図 51



[Drawing 65]

図 65

制約 1 :

積載荷重(Kg)	かご内法間口(mm)	かご内法奥行(mm)
700	1550	1100
800	1650	1150
850	1550	1300
850	1750	1200
950	1650	1350
950	1850	1250
1000	1750	1400
1050	1950	1300
1100	1850	1450

制約 2 : (かご外法間口) = (かご内法間口) + 50

制約 3 : (かご外法奥行) = (かご内法奥行) + 200

制約 4 : (昇降路間口) ≥ (かご外法間口) + 350

制約 5 : (昇降路奥行) ≥ (かご外法奥行) + 450

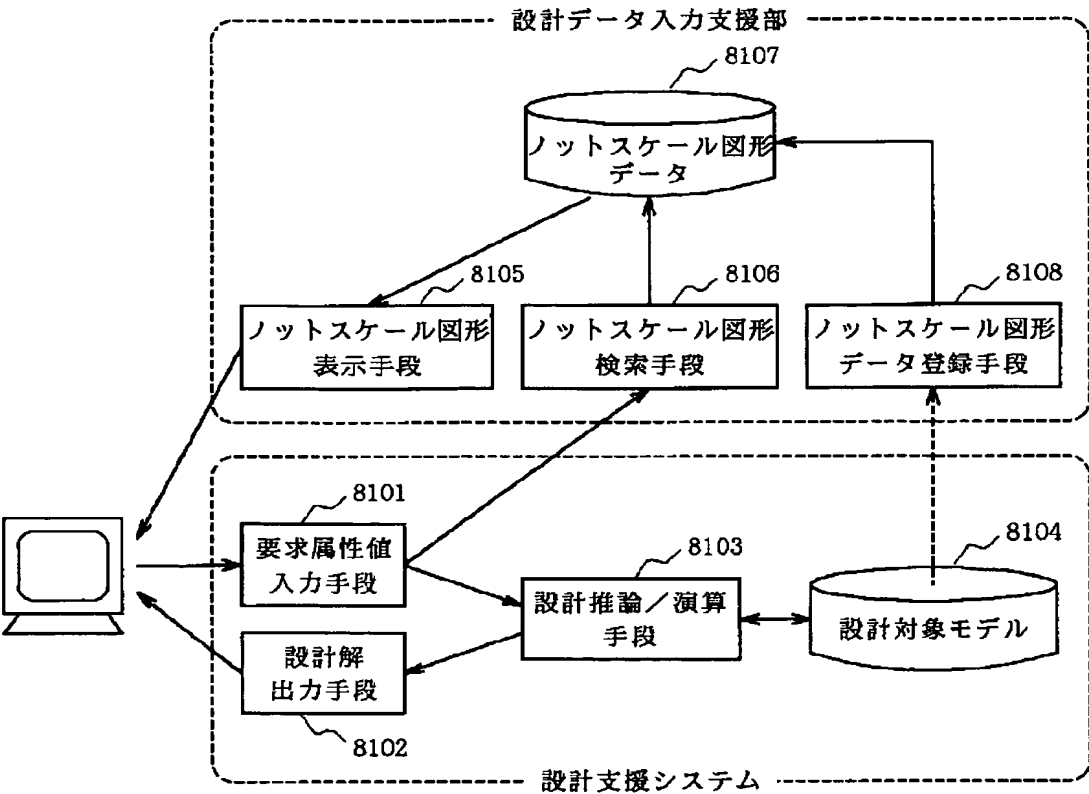
[Drawing 67]

図 67

制約番号	緩和レベル
1	非標準 2
2	除去
3	標準
4	標準
5	非標準 1
6	標準

[Drawing 54]

図 54



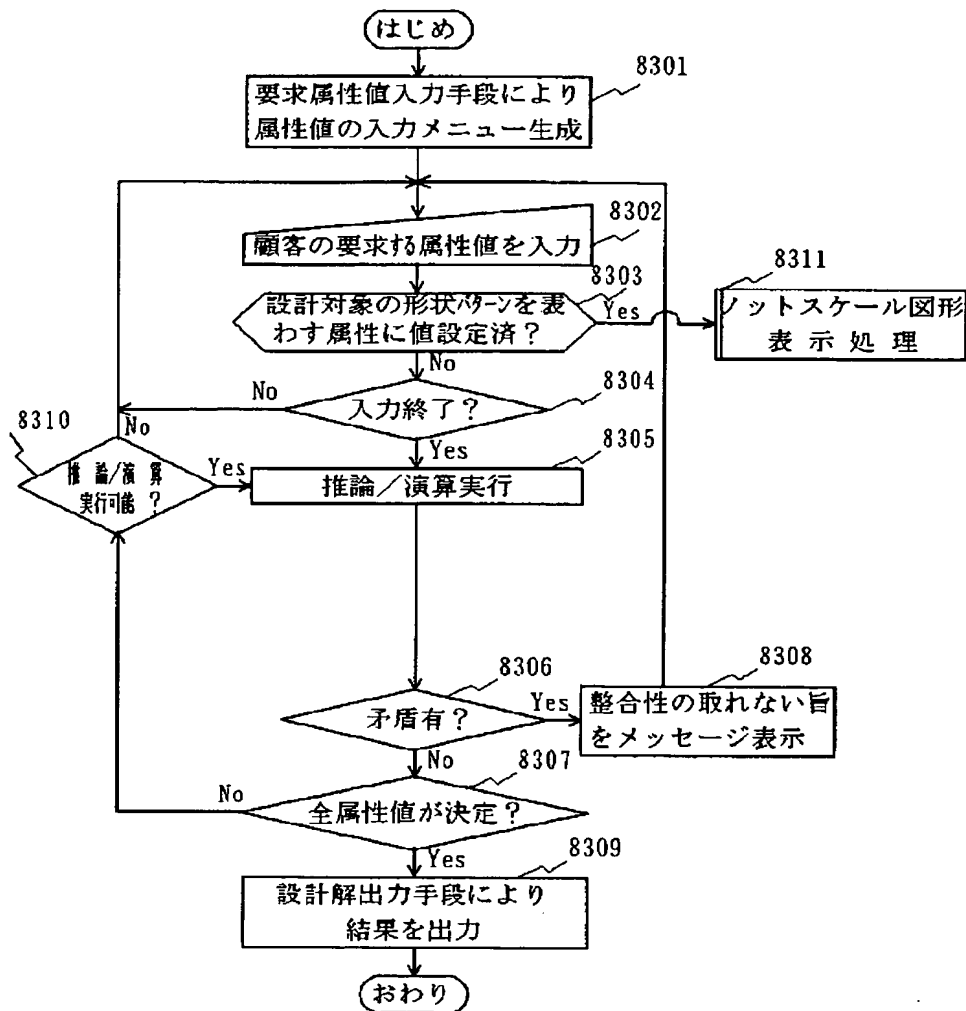
[Drawing 68]

図 68

制約番号	緩和レベル	設計意図
1	標準	
2	非標準 2	強度不足
3	標準	
4	非標準 1	顧客指定
5	除去	対象形状が特殊
6	標準	

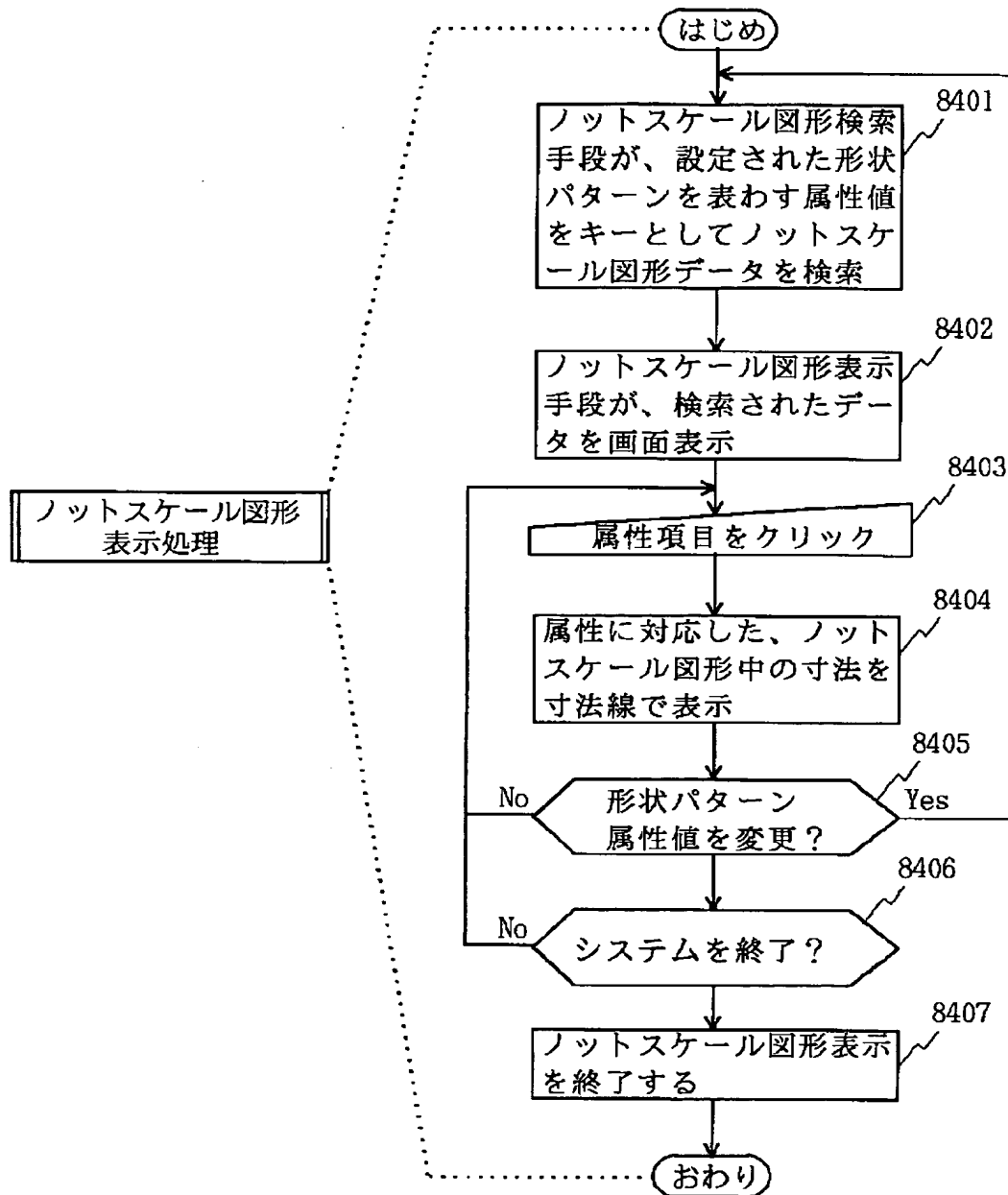
[Drawing 56]

図 56



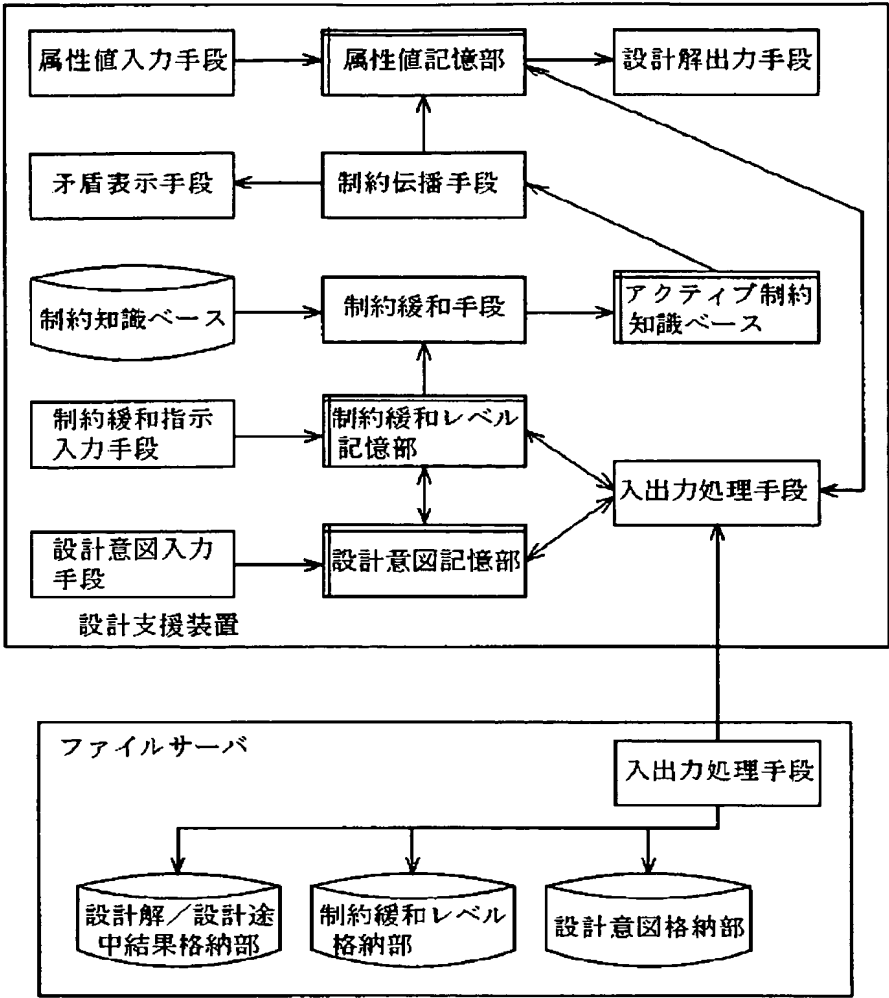
[Drawing 57]

图 57



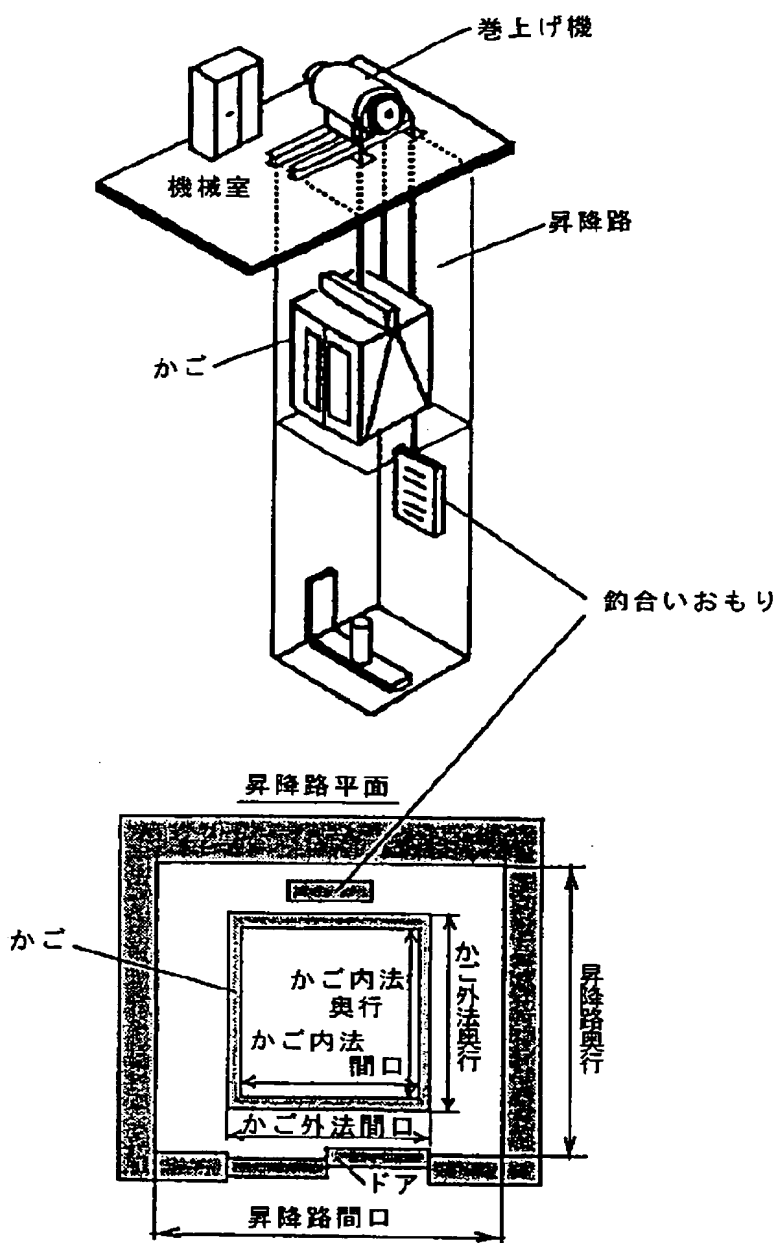
[Drawing 61]

図 61



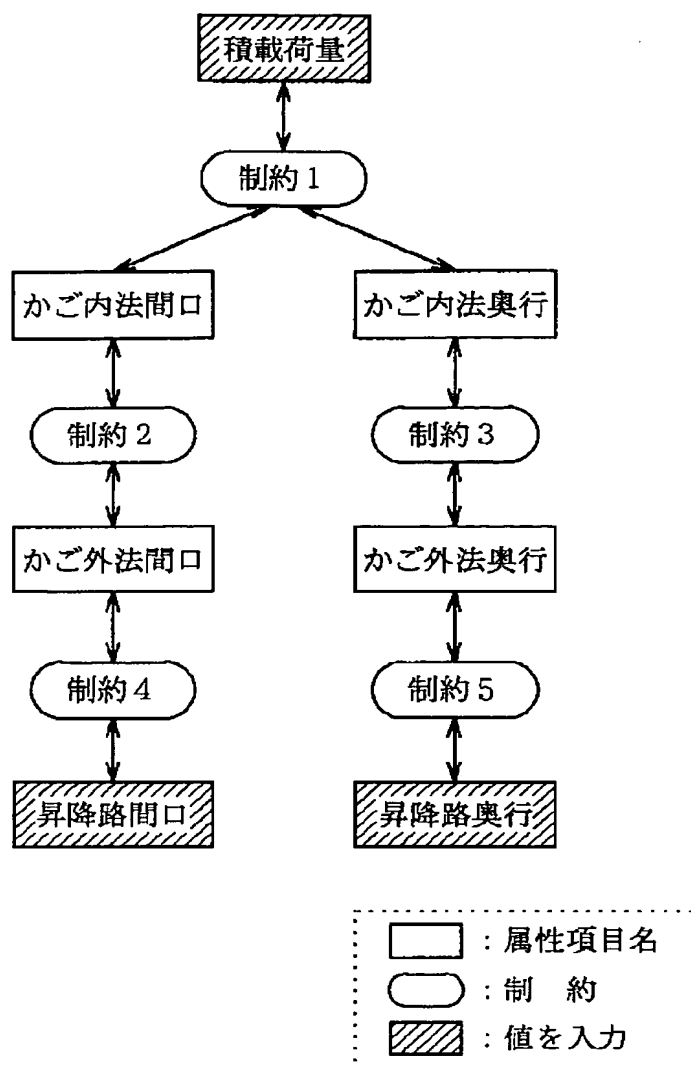
[Drawing 63]

図 63



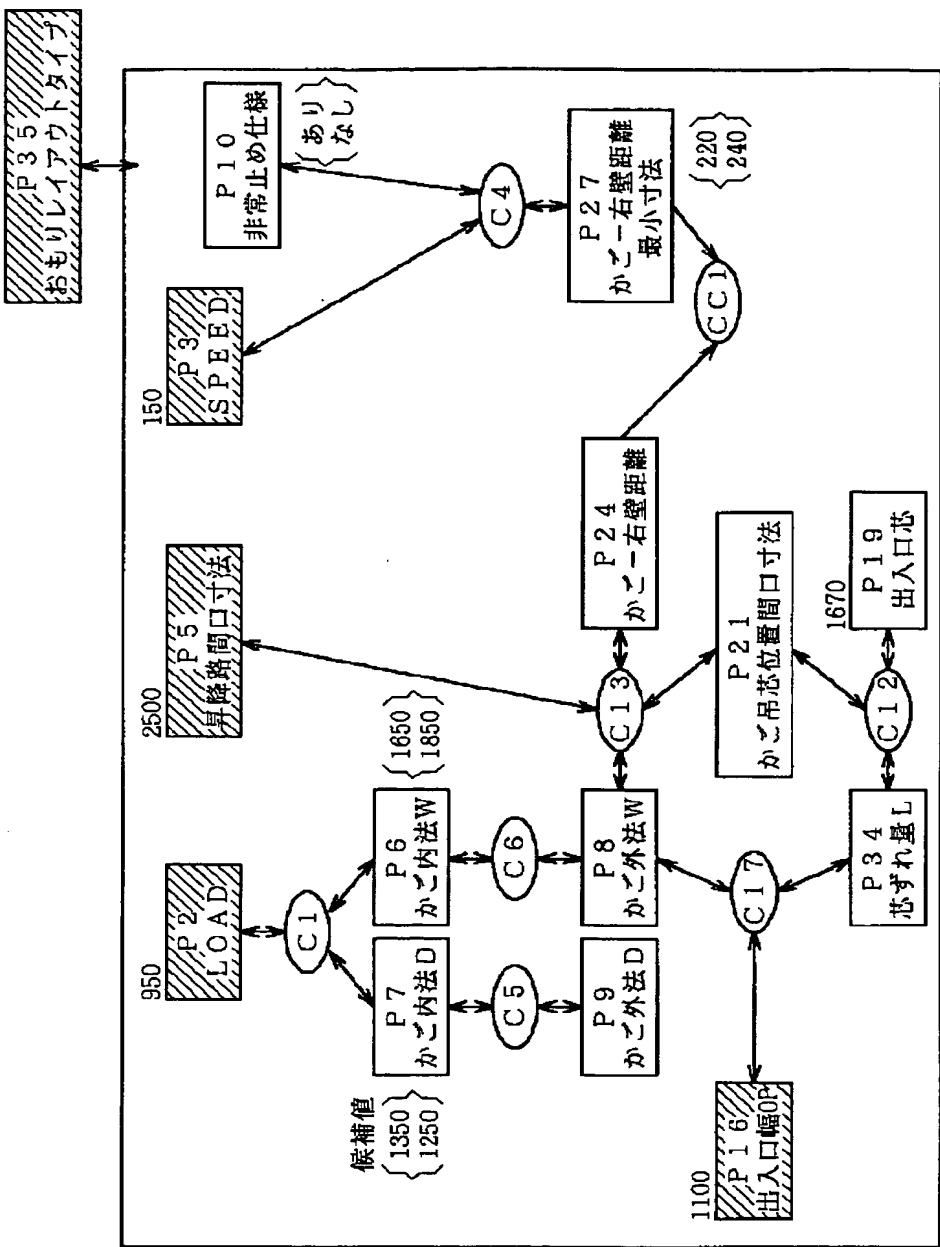
[Drawing 64]

図 6 4



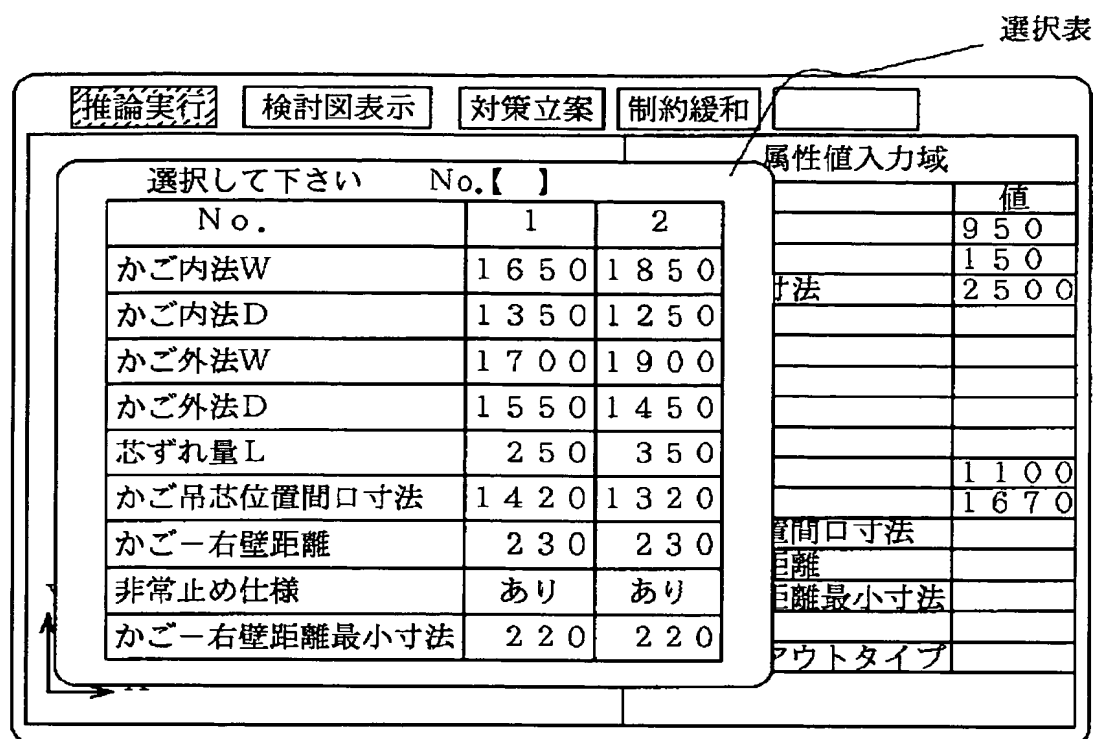
[Drawing 69]

図 69



[Drawing 70]

图 70



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